CHAPTER 3

3. AFFECTED ENVIRONMENT

3.1. Regional Setting

The Watts Bar Dam drainage basin encompasses 17,310 square miles in Tennessee, North Carolina, and Virginia. It lies predominantly within two physiographic provinces: Ridge and Valley, and Blue Ridge Mountains often described as the Great valley. The geology of the Great valley of East Tennessee consists of a system of sedimentary sandstones, shale, and limestone formations. This upper part of the Tennessee River Valley is underlain by folded and faulted Paleozoic rock formations. Most of the folds are compressed and many of then have been overturned, and thrust or reverse faults have developed along them often repeating and overlapping along each fault in a shingle-like structure (TVA, 1948).

Watts Bar Reservoir is centrally located in the Appalachian Ridge and Valley physiographic province of mideast Tennessee (Fennerman, 1938; Miller, et al., 1966) and is within the Appalachian oak forest as described by Kuchler (1966). The Ridge and Valley province, with elevations of 2,000 to 3,000 feet (600 to 900 meters), consists of northeast-southwest trending valleys and streams. About 1,834 square miles of drainage lies within the watershed draining directly into Watts Bar Reservoir.

Watts Bar Reservoir was impounded in1942 by Watts Bar Dam located at Tennessee River Mile (TRM) 529.9. Watts Bar is a fairly large reservoir with 39,000 acres of surface area. The total length of the reservoir, including the Clinch River arm is about 96 miles, the shoreline length is 783 miles. The reservoir extends 73 miles up the Tennessee River to Fort Loudoun Dam and 23 miles up the Clinch River to Melton Hill Dam. It flows from the northeast through portions of four counties in Tennessee: Loudon, Roane, Meigs and Rhea. The principal towns on Watts Bar Reservoir are Spring City, Kingston, Loudon, Rockwood, Lenoir City, Oak Ridge and Harriman all have water intakes or outfalls on the reservoir, and access to commercial navigation. Rural populations are concentrated in the numerous long valleys between the forested ridges. Two major interstate highways meet just in the northeast of Watts Bar and the reservoir is surrounded with several first class railroads, state and federal highways connecting the major communities with a large part of the Eastern United States.

Besides Watts Bar Dam, TVA has major electric power producing facilities on or near the reservoir at Kingston Fossil Plant on the Clinch River near Kingston Tennessee and at Watts Bar Nuclear Plant near Watts Bar Dam. The U. S. Department of Energy (USDOE) has its Oak Ridge Facilities on the upper reaches of Watts Bar Reservoir on the Clinch River. There are several barge terminals and industrial park areas near the larger communities, and some concentrations of residential shoreline developments and marinas, but most of the Watts Bar Reservation Shoreline can be typified as appearing forested and rural.

3.2. Terrestrial Ecology (Plant and Animal Communities)

Watts Bar Reservoir lies almost completely within the Central Ridge and Valley section of the Ecological Subregion referred to as the Eastern Broadleaf Forest (Oceanic) Province (Bailey et al., 1994). A small portion of the upper Watts Bar Reservoir is part of the Cumberland Plateau. Küchler (1964) classifies the main vegetation type of the Central Ridge and Valley as Appalachian oak forest. The potential natural vegetation may consist of cold-deciduous broad-leaved forest with evergreen needle-leaved trees (Bailey, 1995). The main forest type is oak-pine, with blackjack oak, chestnut oak, post oak, scarlet oak, and southern red oak dominating drier sites and the moister sites dominated by white oak, southern red oak, and black oak. Shortleaf pine can form a major portion of the canopy. Other common trees that constitute a minor portion of the vegetation composition are: black gum, several hickory species (bitternut, mockernut, pignut, and shagbark), loblolly pine and sweetgum (Bailey, 1995).

The Ridge and Valley province, with elevations of 2,000 to 3,000 feet (600-900 meters), consists of northeast-southwest trending valleys on limestone bedrock and intervening ridges of more resistant sandstones (Martin and Boyce, 1993). Analysis conducted by TVA for the Shoreline Management Initiative EIS (TVA, 1998), found that tree cover comprised 64 percent of the vegetation within 25 feet of the shoreline and 59 percent of the vegetation between 25 feet and 100 feet from the shoreline. The next most common vegetation type along the Watts Bar shoreline was tree cover with grass understory comprising around 30 percent. This study also found that for two counties, Loudon and Meigs, which border portions of Watts Bar Reservoir, at least 20 percent of their forest area occurs within one-fourth mile of the reservoir shoreline.

The approximately 16,000 acres of TVA public land surrounding Watts Bar Reservoir can be broken into five broad community types: (1) forestland; (2) open/agricultural land; (3) shrub/brush land; (4) wetland/riparian/shallow overbank areas (flooded portion of reservoir outside the original river bed area); and (5) residential/suburban habitats. Approximately 6,800 acres of this property was inventoried in 1994, see Table 3.2-1

Table 3.2-1 Vegetation Type of the 1994 Inventory

Vegetation Type	Acres	Percent of Total
Hardwoods	2,810	41.5
Softwoods (Pines)	2,208	32.5
Mixed-pines, Cedar, and Hardwood	1,593	23.5
Eastern Red Cedar	33	0.5
Open/Idle/Agriculture	127	2.0

Past land use has played a major role in creating the present mosaic of forest conditions. When TVA acquired properties around Watts Bar Reservoir, the land uses were typical of most other lands in the Tennessee Valley. There was, primarily small subsistence farming on marginal land with row crop and pasture areas interspersed with woodlands. Many of these woodlands were grazed by livestock or burned regularly to promote the growth of annuals and other forage plants. Woodlots were also selectively harvested periodically to provide construction lumber, firewood, and other wood products with many of these areas

being subject to severe soil erosion. Following purchase by TVA, much open land was either planted to loblolly or shortleaf pine by TVA or reverted naturally to Virginia pine, red cedar, hickory, and other hardwoods.

While a variety of hardwood types are present on TVA Watts Bar Reservoir lands, upland hardwood comprises the most significant portion of the stands. Typical species that occur in these stands include white oak, black oak, chestnut oak, southern red and scarlet oak, hickories, yellow poplar, red maple, and beech. Mixed pine/hardwood stands include several of the these upland species in addition to sweetgum, sugar maple, white ash, chinkapin oak and Virginia, white, shortleaf and/or loblolly pines. Bottomland hardwoods comprise a relatively small portion of the stands and are typically comprised of sweetgum, slippery and American elms, and various oaks including some large willow oaks in some areas. Pine stands are second to hardwoods in area coverage and are comprised of natural Virginia, shortleaf and white pines and several hundreds of acres of planted loblolly pine. There are a variety of stand ages across the reservoir with the upland hardwood component comprising the majority of the older age forest stands. Most mixed forest stands range in size from poles to large sawtimber and are a variety of age classes.

The once substantial pine stands on Watts Bar Reservoir land have undergone significant changes in recent years due to a major outbreak of Southern pine bark beetles in the late 1990s. These insects decimated most all of the planted loblolly pine stands and infested the majority of mixed pine stands throughout the reservoir area. Aerial surveys conducted by TVA estimate that approximately 90 percent of the pine stands scattered around the reservoir have been severely impacted by the beetles with high mortality. As a result, there has been a substantial increase in reverting or shrub/brush habitat. Most of the beetle impacted areas are slowly reverting back to mixtures of Virginia, loblolly, or shortleaf pine with various hardwoods depending on the site including yellow poplar, sweetgum, sassafras, winged elm, various oaks and other common hardwood species. However, before the new tree cover becomes established many of these areas will go through an herbaceous/shrubby reversion stage which includes plants such as annual ragweed, lamb's quarters, spiny amaranth, panic grass, plume grass, sericea lespedeza, yellow crownbeard, tall ironweed, Canadian goldenrod, common blackberry, Japanese honeysuckle and winged sumac.

Deciduous hardwood forests typically support the greatest diversity of wildlife (see Appendix C, Table C-1). Common mammals in this type include gray squirrel, white-tailed deer, red bat, short-tailed shrew, and white-footed mouse. The bird community includes species present throughout the year, species which nest in the region and migrate to winter in the Caribbean and in Latin America (often referred to as neotropical migrants), and species which winter in the region. Common birds present throughout the year include eastern wild turkey, red-shouldered hawk, woodpeckers, blue jay, Carolina chickadee, tufted titmouse, and Carolina wren. Common neotropical migrants include the yellow-billed cuckoo, wood thrush, red-eyed vireo, hooded and Kentucky warblers, and summer tanager. Wintering birds include the golden-crowned kinglet, winter wren, and yellow-rumped warbler. Among the common reptiles and amphibians found in deciduous forests are eastern box turtle, five-lined skink, black rat snake, dusky and slimy salamanders, American toad, and Cope's gray treefrog.

In recent years neotropical migrant birds associated with interior forest habitats have been used as ecological indicators, and their population numbers have been used to detect environmental changes, monitor organic pollutants, monitor radionuclide contamination,

indicate changes in water quality, and indicate changes in prey stock (food webs) (Furness and Greenwood, 1993). Many neotropical species have undergone significant population declines in recent years due to changes associated with their habitat (Robbins, et al., 1989b, DeGraaf and Rappole, 1995). In order to determine a habitat's viability as interior forest, Temple and Cary (1988) developed a model that used 200 meters as the threshold distance to forest edge. In this methodology, interior-forest habitat requires at least a 200-meter buffer from any feature that breaks the tree cover, such as roads, rivers (reservoirs), or buildings. Using this criterion, Watts Bar Reservoir properties that support the greatest amount of interior forest habitat and/or potential for future interior habitat development include Parcels 7 and 8 (Fooshee Peninsula), 46 (Thief Neck Island), Parcels 142, 143, 145, 146 (former Clinch River Breeder Reactor Site), and Parcels 297 and 298 (Lowe Branch area). There are no current population data on the neotropical, area sensitive bird species that are currently utilizing the habitats on portions of these parcels nor the exact acreage figure of qualifying interior forest. However, there has been some preliminary discussion with members of the TOS and TWRA regarding the nomination and placement of some of these areas into the State of Tennessee's Important Bird Area designation program.

Coniferous or pine forests typically support fewer wildlife species than deciduous forests, and the number of species present increases with the proportion of deciduous trees present and the density of the understory shrub layer. Amphibians and reptiles commonly found in pine and mixed pine/cedar forests include eastern narrow mouth toad, eastern spadefoot, southern five-lined skink, and black racer. Birds commonly found in this type habitat include eastern wild turkey, blue jay, northern cardinal, American crow, sharp-shinned hawk, and a variety of woodpeckers. Edges along pine and cedar woodlands often provide habitat for mammals such as eastern cottontail rabbit, white-footed mouse, hispid cotton rat, and their associated predators. In many cases the edges of these pine/cedar stands are dominated by more herbaceous/shrubby vegetation including several species of goldenrod, asters, bush clover, milkweed, broom-sage, wild oat grass, tick-trefoil, foxtail grass and winged sumac.

Shrub/brush and early successional habitats are widespread and common on Watts Bar Reservoir lands, especially since the southern pine bark beetle outbreak of the late 1990s. Beetle devastated pine stands are reverting to these habitats throughout the reservoir to the benefit of wildlife that utilize these areas. Common amphibians and reptiles found in this habitat type include American toad, spring peeper, upland chorus frog, and common garter snake. Birds that nest in these habitats include eastern wild turkey, eastern towhee, brown thrasher, mockingbird, white-eyed vireo, field sparrow, song sparrow, eastern bluebird, common yellowthroat and prairie warbler. Mammals seeking food and cover in these habitats include white-tailed deer, eastern mole, eastern cottontail rabbit, woodchuck, gray fox and coyote.

Agricultural and grassland habitats are relatively uncommon on Watts Bar Reservoir properties comprising only a few hundred acres. Lands licensed to individual farmers by TVA are being farmed exclusively to grow hay forage crops for livestock. The majority of these fields are planted to cool season grasses, predominantly Kentucky fescue with some orchard grass and clover and are mowed two to three times during the growing season for hay crops. Older fields that are more infrequently mowed support several coarse herbs and shrubs including annual ragweed, lamb's quarters, pigweed, panic grass, sericea lespedeza, tall ironweed, Canada goldenrod, common blackberry, northern dewberry, Japanese honeysuckle and winged sumac. The frequently mowed open hayfield areas

provide somewhat limited wildlife habitat. Bird species that use these areas include resident Canada geese, eastern bluebird, eastern meadowlark, American crow, American kestrel, and red-tailed hawk. Amphibians and reptiles utilizing these habitats, at least on a seasonal basis, include spring peeper, western chorus frog, and eastern garter snake. Utilizing Breeding Bird Survey data from 1996 to 1992, Peterjohn et al. (1995) reported that birds of grasslands experienced the most significant and consistent declines throughout the Southeast. In an effort to offset this trend on a local landscape level, TVA Biologists partnered with the Tennessee Wildlife Resources Agency and agricultural licensees to plant and establish stands of native warm season grasses on portions of the Watts Dam Reservation (Parcel 3) over the last several years. To date, approximately 30 acres of mixed native grass stands have been successfully established. Grassland bird species, in particular northern bobwhite quail and grasshopper sparrows, have responded positively to this management effort.

Invasive terrestrial plant species typify disturbed, early successional vegetation throughout the Watts Bar Reservoir area. Several previously mentioned species such as Japanese honeysuckle and sericea lespedeza along with Chinese privet, multi-flora rose, kudzu, autumn olive, tree of heaven, nepalgrass, bush honeysuckle and mimosa are widespread and common. Bottomlands, or periodically flooded narrow floodplain areas, are often dominated by Chinese privet and/or nepalgrass in the understory to the total exclusion of native flora. Many of these exotic invasive plant species are negatively affecting some of the uncommon natural plant communities scattered around Watts Bar Reservoir. TVA has taken action in previous years to chemically control some kudzu growth at specific sites and plan to expand this work on several areas through implementation of the Integrated Resources Management Plan.

Riparian/shallow water/overbank habitats are widespread and common on Watts Bar Reservoir with its 771 shoreline miles and almost 29,000 acres of overbank. These shallow water/riparian habitats, coupled with a consistent fish forage base, provide excellent habitat for several fish-eating bird species. Great blue and black-crowned night herons, along with a growing number of cattle egrets and double-crested cormorants, are common throughout the reservoir area with numerous nesting colonies being located on TVA retained properties. Osprey, formally listed as endangered in Tennessee, have consistently increased in numbers since the first successful nesting attempt in 1977. TWRA annually conducts a census of the active osprey nests and tallied around 120 nests during the 2004 nesting season. Nesting bald eagles have also returned to Watts Bar since the previous plan was written with three active nests known from the reservoir area in 2004, see Section 3.3.

Other wildlife utilize the riparian and wetland habitats along the reservoir. Numerous other birds, including some neotropical migrant species such as prothonotary warbler, blue-gray gnatcatcher, and northern parula warbler, utilize this habitats. Some of the more common waterfowl species seen include mallards, American black ducks, hooded mergansers, resident Canada geese, and wood ducks. There are also other water/wading birds, such as, green herons, great egrets, pied-billed and horned grebes, and various tern and gull species. Common amphibians include green frog, narrow-mouthed toad, and Fowler's toad while reptiles are represented by northern water snake, common snapping turtle, painted turtles, and red-headed sliders. Mammals that use these habitats include mink, muskrat, raccoon and beaver.

3.3. Sensitive (Endangered and Threatened) Species

Sensitive species includes any plant or animals listed under the Endangered Species Act or similar state laws or regulations, as well as any species or community of species considered to be rare, uncommon, in need of management, or of special consideration. The sensitive species in this section are those which are found in the area of Watts Bar Reservoir. The discussion of sensitive species is presented in three sections, namely, plants, terrestrial animals, and aquatic animals.

3.3.1. Plants

The rare plants known from the area surrounding Watts Bar Reservoir are found in many different types of terrestrial plant communities (Pyne and Shea, 1994b). The major plant communities surrounding Watts Bar Reservoir include the following: Forested Bluffs and Rocky Slopes; Mesic Deciduous Forests; Moist Woodlands; Forested Streamsides, Seeps, and Bogs; Forest Edges, Roadsides, and Fencerows; Prairies, Barrens, and Open Woodlands; Marshes, Wet Meadows, and Open Streamsides; and, Gravel Bars and Boulders in Rivers and Large Streams. Each of these communities is described briefly below.

The Forested Bluff and Rocky Slope community is dominated by white pine and Northern white cedar. Plants commonly found in the canopy layer are northern red oak and white oak. Plants commonly found in the understory are sassafras, serviceberry, leatherwood, and maple-leaf viburnum. This community contains the most rare plant species.

The Mesic Deciduous Forest typically has basswood, yellow buckeye, beech, tulip poplar, and sugar maple in the canopy layer and flowering dogwood, sourwood, umbrella magnolia, witch hazel and striped maple in the understory.

The Moist Woodlands community includes cove slopes, ravines, valley floors, and floodplain forests. This community commonly contains river birch, green ash, sycamore, willow oak, and swamp chestnut oak.

The Forested Streamsides, Seeps and Bogs community type is dominated by sycamore, box elder, basswood, sugar maple and Eastern hemlock.

Forest Edges, Roadsides, and Fencerows are typified by fast-growing, opportunistic vegetation and are often dominated by exotic woody vegetation such as Chinese privet, tree-of-heaven, mimosa, princess tree and Japanese honeysuckle. Typical native vegetation includes eastern red cedar, blackgum, osage orange and New Jersey tea.

Prairies, Barrens, and Open Woodlands typically have an abundance of grasses such as big blue steam and side oat gamma grass in addition to scattered trees such as eastern red cedar, post oak and blackjack oak.

Marshes, Wet Meadows, and Open Streamsides are dominated by different species of grasses, sedges, and rushes. Small trees such as black willow, tag alder, button bush, and silky dogwood, as well as numerous fern species are typical of this community type.

Gravel Bars and Boulders in Rivers and Large Streams are typically dominated by black willow, tag alder, button bush, and silky dogwood. Occasionally, Virginia spirea and Cumberland rosemary may occur in this community type.

Various sources were used to compile a list of sensitive plant species known to occur or to have suitable habitat on lands within or adjacent to Watts Bar Reservoir. These sources included the TVA Regional Natural Heritage Project's database, the Watts Bar Land Management Plan (TVA, 1988), the data for Watts Bar Reservoir from the Shoreline Management Initiative (TVA, 1996), the 2000 Lower Watts Bar Management Unit Resource Management Plan and Environmental Assessment (TVA, 2000), as well as the University of Tennessee Herbarium database. Field inventories were done on Watts Bar in 1984 by Dr. Gene Wofford, of the University of Tennessee Herbarium and in1996 by Dr. Larry Pounds, a TVA contract botanist.

At present, no known populations of plants listed by the federal government as threatened or endangered occur on TVA land and Watts Bar Reservoir. However four populations of Virginia Spirea (*Spirea virginiana*) and one population of Cumberland Rosemary (*Condridina verticillata*), occur within one mile of WBR on the Emory River. Both of these species are listed as Threatened at the federal level. In addition, there is a historical record of American Hart's tongue fern (*Asplenium scolopendrium* var. *americanum*), a federal listed threatened species, last observed in 1849 in a cave approximately two miles west of Caney Creek. There are the 37 state listed threatened and endangered species that occur in the vicinity of Watts Bar Reservoir, and 12 of these occur on TVA land. A listing of rare plant species and the community types that they are found in is provided in Table 3.3-1.

Table 3.3-1 Listed plant species by community type known from or potentially occurring adjacent (within five miles) of Watts Bar Reservoir

Plant		Status		Community[3]							
Common Name	Scientific Name	Federal[1]	State[2]	FBRS	MDF	MW	FSSB	FERF	PBOW	MWOS	GB
Ear-leaf foxglove	*Agalinis auriculata*		END						X		
American hart's-tongue fern	*Asplenium scolopendrium* var. *americanum*	LT	END	X							
Barren's silky aster	*Aster pratensis*		THR						X		
Spreading false-foxglove	*Aureolaria patula*		THR	X							
American barberry	*Berberis canadensis*		SPCO					X			
Heavy-fruited sedge	*Carex gravida*		SPCO	X							
Hairy sharp-scaled sedge	*Carex oxlepis* var. *pubescens*		SPCO	X		X					
Appalachian bugbane	*Cimicifuga rubrifolia*		THR	X							
Cumberland rosemary	*Condridina verticillata*	LT	THR								X
Pink lady-slipper	*Cypripedium acaule*		E-CE			X					
Tall larkspur	*Delphinium exaltatum*		END						X		
Northern bush-honeysuckle	*Diervilla lonicera*		THR	X							
Mountain bush-honeysuckle	*Diervilla rivularis*		THR	X							
Waterweed	*Elodea nuttallii*		SPCO							X	
Catfoot	*Gnaphalium helleri*		SPCO						X		
Mcdowell's sunflower	*Helianthus occidentalis*		SPCO						X		
Goldenseal	*Hydrastis canadensis*		S-CE		X						
Butternut	*Juglans cinerea*		THR			X					
Short-head rush	*Juncus brachycephalus*		SPCO				X				

Plant		Status		Community[3]							
Common Name	Scientific Name	Federal[1]	State[2]	FBRS	MDF	MW	FSSB	FERF	PBOW	MWOS	GB
Fetter-bush	*Leucothoe racemosa*		THR							X	
Slender blazing-star	*Liatris cylindracea*		THR						X		
Canada lily	*Lilium canadense*		THR					X		X	
Loesel's twayblade	*Liparis loeselii*		PT			X					
Mountain honeysuckle	*Lonicera dioica*		SPCO	X							X
Large-flowered Barbara's-buttons	*Marshallia grandiflora*		END								X
American ginseng	*Panax quiquefolius*		S-CE		X						
Swamp lousewort	*Pedicularis lanceolata*		SPCO				X				
Pale green orchid	*Platanthera flava* var. *herbiola*		THR			X					
Dwarf milkwort	*Polygala nana*		END	X							
Pursh's wild-petunia	*Ruellia purshiana*		SPCO			X					
River bull rush	*Scirpus fluviatilis*		SPCO							X	
Prairie goldenrod	*Solidago ptarmicoides*		END						X		
Virginia spiraea	*Spiraea virginiana*	LT	END								X
Shining ladies'-tresses	*Spiranthes lucida*		THR							X	
Northern white cedar	*Thuga occidentalis*		SPCO	X							
Three parted violet	*Viola tripartata*		SPCO			X					

* Plants discussed in text; the remaining species are reported from within five miles of WBR

[1] **LT**: Federal listed threatened

[2] Status Codes:

END - Endangered
THR - Threatened
SPCO - Special Concern
E-CE - Endangered, Commercially exploited
S-CE - Special Concern, Commercially exploited
PT - Proposed Threatened

[3] Community Codes:

FBRS: Forested bluff and rocky slope community
MDF - Mesic deciduous forest
MW - Moist woodlands
FSSB - Forested stream-sides, seeps and bogs
FERF - Forest edges, roadsides, and fencerows;
PBOW - Prairies, Barrens, and open woodlands
MWOS - Marshes, wet meadows and open stream-sides
GB - Gravel bars and boulders in rives and large streams.

Spreading false-foxglove (*Aureolaria patula*). Twenty-three populations of false foxglove (state listed Threatened) have been reported on and around the Watts Bar Reservoir property. There is one population on the lower Watts Bar Reservoir property (TRM 530-547) on Parcel 248. Five populations occur in the middle portion of the reservoir property between TRM 544 and 573 on Parcels 61, 70, 81, 83, and 196. Six populations occur from the confluence of the Clinch River at TRM 568 to TRM 599 on Parcels 91and 94. Four other populations occur in the area within Zone 1, but are not associated with any parcel. Eleven populations occur in the upper part of the reservoir property (along the Clinch and Emory Rivers) on Parcels 126, 148, 152 and 194. The remaining seven populations occur in Zone 1, and are not associated with any parcel. According to Kral (1983), this plant is a member of the figwort family, is a perennial herb, and is parasitic on the roots of oaks. It grows on steep, dry partially-shaded calcareous slopes above large streams and rivers. It

is often found near water. False-foxglove is sensitive to the loss of overstory shading and does not tolerate competition from weedy vegetation. This species is sparsely distributed in a narrow range, with limited habitat (NatureServe, 2004).

Appalachian bug-bane (*Cimicifuga rubrifolia*). This species is listed as Threatened by the state of Tennessee. Four populations of this member of the buttercup family have been found on Watts Bar Reservoir on Parcels 126, 128, 132, and 196. It is a perennial herb and is rare throughout its range. It typically occurs in cool, moist mixed hardwood forests between 890 to 1575 feet elevation (270 to 480 m). However, plants have been found at elevations as high as 2,950 feet elevation (900 m). Approximately fifty occurrences are known for the species (NatureServe, 2004).

Northern bush-honeysuckle (*Diervilla lonicera*). Two populations of this woody shrub were found growing on limestone cliffs of Watts Bar Reservoir on Parcels126 and 196. A member of the honeysuckle family, this plant is listed as Threatened at the state level. It grows in rocky woodlands often associated with limestone or sandstone bluffs (Kral, 1983).

American barberry (*Berberis canadensis*). One population of this plant was found around TRM 593 within a Zone 1 area. This occurrence was determined to be a county record. Barberry is listed by the state as a species of Special Concern. The plant is a woody shrub about 1 to 7 feet tall (Radford et al., 1968). Collections at the University of Tennessee-Knoxville Herbarium suggest that the habitat consists of relatively open woodlands, because specimens have been made from wooded slopes, shale slopes, bluffs, terraces along river bluffs, and river banks. In the past, American barberry was distributed in open savannas and woodlands where habitat was maintained by fire. Fire suppression has significantly restricted its habitat to sites with shallow soil (e.g., glades and cliffs) or areas that experience periodic mowing or other canopy-clearing activities, such as transmission line or railroad/road right-of-ways, and riverbanks (NatureServe, 2004)

Mountain bush-honeysuckle (*Diervilla rivularis*). One population of this state listed Threatened species was found along Watts Bar Reservoir on Parcel 121. Mountain bush-honeysuckle occurs in damp woods and rocky banks and bluffs in full sun in disturbed areas (Wofford and Chester, 2002). It is somewhat threatened by land-use conversion, habitat fragmentation, and forest management practices (NatureServe, 2004).

Fetter-bush (*Leucothoe racemosa*) Fetter-bush is a state listed species of Special Concern and is member of the heath family. One population was found in 1984 growing on the shoreline of the upper Watts Bar Reservoir at TVA's Kingston Fossil Plant. According to Wofford and Chester (2002), this is a deciduous shrub that grows in wet woods, gravel bars, and on stream banks.

Canada lily (*Lilium canadense*). One population of Canada lily was found on the upper Watts Bar Reservoir growing across the river from Parcel 141. Three additional populations are known to occur within five miles of the reservoir. This state-listed Threatened species grows in sunny areas having acidic soil, such as bogs, meadow, low thickets, and balds. They have also been found growing in roadside ditches and along the edges of woods (Pyne and Shea, 1994a).

Mountain honeysuckle (*Lonicera dioica*). A population of this state listed species of Special Concern is located in the Sugar Grove Habitat Protection Area (Parcel 152) on the Clinch

River. Mountain honeysuckle is infrequently found in open woods and riverbanks (Wofford and Chester, 2002).

Large flowered Barbara's buttons (*Marshallia grandiflora*). There is an historic record for this state-listed Endangered species from the Emory River of the upper Watts Bar Reservoir near ERM 12. This plant is member of the Aster family. It is native to the Appalachians and is known from only 11 watersheds throughout its range. It occurs along flood-scoured banks of large, high-gradient rivers in the central Appalachians. This species is also reported from rocky lake shores, creek banks, bluffs, and floodplains. It tends to occur in moist to wet sandy soil, in sandy/cobbley alluvium, or in bedrock crevices along rivers (NatureServe, 2004). According to Pyne and Shea (1994a) in Tennessee, Cumberland Rosemary, a federal Threatened species, is often associated with, and found near, large flowered Barbara's buttons.

Pursh's wild petunia (*Ruellia purshiana*). This perennial herb is state listed as Special Concern. One population was found growing in Zone 1 within 500 feet of the Clinch River at CRM 22.5. Weakley (2005) lists the habitat as dry woodlands, forest and glades especially over magnesium, iron, and calcium-rich rocks.

Northern white cedar (*Thuja occidentalis*). A member of the cedar family, this tree is state listed as Special concern. It is a conifer with a narrow, almost columnar crown. On upland sites, northern white-cedar grows primarily in calcium-rich soils and clays, and shallow loam overlying broken limestone (NatureServ, 2004). On Watts Bar Reservoir, there is one historical population occurring in an area of limestone cliffs with seepage areas above the Emory River between ERM 11 and 12.

Shinning ladies tresses (*Spiranthes lucida*). Shinning ladies tresses, a state-listed Threatened orchid is primarily found in disturbed areas where the water supply is plentiful, such as open areas along creek- banks, wet meadows, marshes, lakeshores, and sandbars of streams. According to Pyne and Shea (1994b) the plant is small and easily overlooked. One population was found on upper Watts Bar Reservoir near Parcel 148.

3.3.2. Terrestrial Animals

The various plant communities on Watts Bar Reservoir provide suitable habitat for a variety of federal and state listed terrestrial animals. These diverse communities include pine forests, mixed hardwood/conifer forest, upland and riparian hardwood forest, wetland, early successional and agricultural lands. Forest stands consist of a mixture of hardwoods and pine; however, recent infestations of southern pine bark beetle have greatly reduced numbers of pine stands in the vicinity. In addition to distinctive vegetated communities, many features such as streams, caves, rock outcrops, and sinkholes found on Watts Bar Reservoir lands provide unique habitats for rare species of wildlife. Although large stands of contiguous forest exist on Watts Bar Reservoir lands, a large portion of the reservoir lands have been developed, primarily for housing developments. This has resulted in fragmenting many of these plant communities.

A majority of wildlife species utilizing the area are not restricted to a single habitat type. Mammals common to the area include white-tailed deer, muskrat, red and gray fox, gray squirrel, eastern cottontail, raccoon, opossum, and striped skunk. Common birds include the field sparrow, song sparrow, white-throated sparrow, yellow-breasted chat, common yellowthroat, indigo bunting, northern cardinal, blue jay, northern bobwhite, eastern wild turkey, wood duck, mallard, black duck, Canada goose, great blue heron, belted kingfisher,

osprey, barred owl, eastern screech owl, and red-tailed hawk. Numerous other wildlife species, including a variety of amphibians and reptiles, are common in the area.

The TVA Regional Natural Heritage Project database was queried to identify federal and state protected terrestrial animals as well as sensitive ecological areas (e.g., caves and heron colonies) from counties surrounding Watts Bar Reservoir. These counties include Loudon, Meigs, Rhea, and Roane Counties in Tennessee. Fourteen sensitive terrestrial animal species, 24 caves, and 37 heron colonies were identified (see Table 3.3-2). One terrestrial animal is federally protected, and the remaining 13 species are protected by the State of Tennessee.

Table 3.3-2 Protected Terrestrial Animals Known to Occur in Loudon, Meigs, Rhea, and Roane Counties, Tennessee.

Common Name	Scientific Name	Federal Status	State Status
Amphibians			
Eastern Hellbender	*Cryptobranchus alleganiensis alleganiensis*	-	In Need of Management
Four-toed Salamander	*Hemidactylium scutatum*	-	In Need of Management
Tennessee Cave Salamander	*Gyrinophilus palleucus*	-	Threatened
Birds			
Bachman's Sparrow	*Aimophila aestivalis*	-	Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	In Need of Management
Common Barn Owl	*Tyto alba*	-	In Need of Management
Least Bittern	*Ixobrychus exilis*	-	In Need of Management
Sharp-shined Hawk	*Accipiter striatus*	-	In Need of Management
Mammals			
Eastern Small-footed Bat	*Myotis leibii*	-	In Need of Management
Gray Bat	*Myotis grisescens*	Endangered	Endangered
Southeastern Shrew	*Sorex longirostris*	-	In Need of Management
Southern Bog Lemming	*Synaptomys cooperi*	-	In Need of Management
Reptiles			
Eastern Slender Glass Lizard	*Ophisaurus attenuatus longicaudus*	-	In Need of Management
Northern Pine Snake	*Pituophis melanoleucus melanoleucus*	-	Threatened

The Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis)* is found in large and mid-size, fast-flowing, rocky rivers at elevations below 2,500 feet (762 meters) (Petranka, 1998). Eastern hellbenders have been documented within the Clinch River and Little Tennessee River watersheds. Suitable habitat for this species exists on many parcels within the Watts Bar Reservoir vicinity.

The Four-toed Salamander (*Hemidactylium scutatum)* occurs in forested swamps, bogs, vernal pools and other fish-free habitats, especially those with mossy banks. This salamander has been reported from Roane County. Suitable habitat for four-toed

salamanders exists within wetlands in Parcels 36 and 111. Additional habitat exists on Parcel 193.

The Tennessee Cave Salamander (*Gyrinophilus palleucus)* is found in several cave systems in the region. This species has been documented from a cave approximately 800 feet (244 meters) from TVA land on Watts Bar Reservoir. Caves containing aquatic systems near Marble Bluff provide suitable habitat for this species.

The Bachman's Sparrow (*Aimophila aestivalis*) is found in grassy openings in mature pine forests but this bird species has also been recorded in old-field habitats. Populations are documented for Rhea and Roane Counties. Suitable habitat for Bachman's sparrows is limited and scattered throughout Watts Bar Reservoir lands. The species may be found in Parcels 3, 295, 297, 298, and 299 near Watts Bar Dam.

Bald Eagles (*Haliaetus leucocephalus*) prefer to nest and roost in large, mid-aged and mature tracts of deciduous forest on Watts Bar Reservoir lands. Although their populations continue to increase in Tennessee River Valley, nesting bald eagles remain uncommon in East Tennessee. Bald eagles have been documented nesting within five parcels of TVA land on Watts Bar Reservoir. Suitable bald eagle nesting habitat is found throughout the project area. Bald eagles regularly roost at various sites along the reservoir during winter months. The largest of these roosts are found in the Paint Rock Wildlife Refuge, Whites Creek embayment, and Thiefneck Island.

Barn Owls (*Tyto alba*) roost and nest in caves, hollow trees, barns, and silos. They forage over open landscape such as abandoned farmland, but also in urban habitat such as vacant lots, cemeteries, and parks (Nicholson 1997). The species has been reported from Rhea County and TVA Kingston Fossil Plant. Suitable habitat for this species is limited and scattered throughout the Watts Bar Reservoir.

Least Bitterns (*Ixobrychus exilis*) inhabit marshes with tall, emergent vegetation bordering open water up to a meter or more deep (Weller 1961). The species has been reported from Meigs County. Suitable habitat for least bitterns can be found within some embayments of the Watts Bar Reservoir. Many of these sites are shallow enough to allow the growth of emergent herbaceous and woody vegetation.

The Osprey (*Pandion haliaetus*) is currently not listed at the state or federal levels; however, the species is tracked by TVA. Ospreys nest in trees, on power line structures, artificial nest platforms, channel markers, and other structures in or near open water. In recent years, osprey populations have increased in Tennessee. Watts Bar has one of the largest populations of nesting osprey compared to other reservoirs on the Tennessee River Valley. There are numerous osprey nests throughout Paint Rock Wildlife Refuge.

Sharp-shinned Hawks (*Accipiter striatus*) nest within coniferous and mixed woodlands. The species has been reported from Roane County. Suitable habitat for sharp-shinned hawks occurs within mixed forests found scattered throughout the Watts Bar Reservoir. Although no active nests have been reported, the species has been observed in the area.

Eastern Small-footed Bats (*Myotis leibii*) roost in crevices in caves, mine tunnels, expansion joints beneath highway bridges, and in buildings (Linzey, 1998). There is one documented record for this species from Rhea County. Forested bluffs in the vicinity of Watts Bar Reservoir provide suitable habitat for this species.

Gray Bats (*Myotis grisescens*) roost in caves and forage over open water habitats. They have been reported from six caves within the vicinity of Watts Bar Reservoir. Only one of these caves is located on Watts Bar Reservoir land. Results of recent surveys at this cave indicate that gray bats roost at this site on a transitional basis during spring and fall migration.

Indiana Bats (*Myotis sodalist*) have not been reported from the vicinity of Watts Bar Reservoir. This species roosts in caves during the winter, and form summer roosts under the bark of living and dead trees. Indiana bats favor mature deciduous forests having open mid-stories with an abundance of trees with exfoliating bark. Suitable habitat for the species exists in the Watts Bar Reservoir lands.

Southeastern Shrews (*Sorex longirostris*) are found in a variety of habitats across Tennessee including moist forests and wetlands. Numerous southeastern shrew records are documented in the vicinity of the Clinch River within the Watts Bar Reservoir area. Suitable habitat for this species exists on most parcels.

Southern Bog Lemmings (*Synaptomys cooperi*) are found in wet pastures, grassy openings in woods, clearcuts, power line rights-of-way and similar habitat. One population of southern bog lemming is known from Rhea County. Suitable habitat for this species exists on most parcels.

Eastern Slender Glass Lizards (*Ophisaurus attenuatus longicaudus*) are found in dry grassland and open woodland habitats. Suitable habitat for glass lizards is found scattered throughout the Watts Bar Reservoir. The upper end of White's Creek (Parcel 233) contains areas of extensive sandy soils which are ideal for this species.

Northern Pine Snakes (*Pituophis melanoleucus melanoleucus*) inhabit sandy pine barrens, dry ridges and hillsides. They have also been found in thickets dominated by Virginia pine, mountain laurel and rhododendron. There is one historical record for this species from Rhea County. Suitable habitat is found scattered throughout the Watts Bar Reservoir.

Caves represent very specialized habitats and a significant number of federal and state listed species exist within caves. Cave habitats are utilized year-around, as roosting and maternity sites by several state and federal endangered species of bats. The state-listed Allegheny wood rat (*Neotoma magister*), Tennessee cave salamander, and common barn owl are also found in caves. According to a review of the TVA Natural Heritage Project database, six caves are recorded along the reservoir and 24 caves are reported from the four county area. Two caves are located on TVA Watts Bar Reservoir land.

Heron colonies are colonial nesting sites used by migratory wading birds. Several species of birds, often in large numbers, nest in these colonies. Birds occupying these sites are sensitive to disturbance, especially during the nesting season.

According to a review of the TVA Natural Heritage Project database, 22 heron colonies are recorded along the reservoir. A majority of these colonies are within parcels designated in the management plan. Most of these colonies contain only great blue herons (*Ardea herodius*) but some are known to contain small colonies of black-crowned night-herons (*Nycticorax nycticorax*) and double-crested cormorants (*Phalacrocorax auritus*). Cattle egrets (*Bubulcus ibis*) are suspected of nesting on Half Moon Island and are known to roost on islands south of Half Moon Island.

The establishment of heron colonies on Watts Bar Reservoir is significant. Great blue heron populations in Tennessee underwent declines in the late 1960's and early 70's (Nicholson, 1997). Recently, heron colonies have increased dramatically throughout the Tennessee River watershed. The establishment of these new colonies suggests that Watts Bar Reservoir may provide suitable nesting habitat for other species of wading birds that are considered uncommon in Tennessee.

3.3.3. Aquatic Animals

A review of data from the TVA Regional Natural Heritage Project database indicated that there are several rare and sensitive aquatic animal species found in Watts Bar Reservoir or in its tributaries in Loudon, Meigs, Rhea, and Roane counties. The official status of those species protected at the sate and federal levels is provided in Table 3.3-3.

Table 3.3-3 State- and Federal-Listed Aquatic Animal Species Reported From Watts Bar Reservoir and its tributaries, and recent status of those species in and around Watts Bar Reservoir.

Common Name	Scientific Name	Federal Status	State Status[1]	Recently Found in Study Area?
Fish				
Tangerine darter	*Percina aurantiaca*	-	NMGT	Yes
Blue sucker	*Cycleptus elongates*	-	THR	Yes
Flame chub	*Hemitremia flammea*	-	NMGT	Yes
Snail darter	*Percina tanasi*	THR	THR	Yes
Spotfin chub	*Cyprinella monacha*	THR	THR	Yes
Tennessee dace	*Phoxinus tennesseensis*	-	NMGT	Yes
Mussels				
Pink mucket	*Lampsilis abrupta*	END	END	Yes
Alabama lampmussel	*Lampsilis virescens*	END	END	No
Rough pigtoe	*Pleurobema plenum*	END	END	Yes
Dromedary pearlymussel	*Dromus dromas*	END	END	No
Fanshell	*Cyprogenia stegaria*	END	END	Yes
Pyramid pigtoe	*Pleurobema rubrum*	-	NMGT	Yes
Fine-rayed pigtoe	*Fusconaia cuneolus*	END	END	No
Purple bean	*Villosa perpurpurea*	END	END	No
Orange-foot pimpleback	*Plethobasus cooperianus*	END	END	Yes
Snails				
Anthony's river snail	*Athearnia anthonyi*	END	END	No

[1] Status Codes: END = Endangered; THR = Threatened; NMGT = Deemed In Need of Management by the Tennessee Wildlife Resources Agency

Fish The state and federal-listed spotfin chub (*Cyprinella monacha*) and state-listed Tennessee dace (*Phoxinus tennesseensis*) do not occur in Watts Bar Reservoir, but are found in tributary streams on non-TVA lands allocated as flowage (Zone 1).

Likewise, the remaining four fish species are primarily found in the tributary streams allocated as flowage areas. However, they are wide-ranging and are known to use the margins and embayment areas of the reservoir, although this is not their preferred habitat. Snail darter (*Percina tanasi*) larvae drift downstream from tributary streams into reservoirs, and as the young develop they migrate back upstream into tributary streams. Snail darters are also found below Watts Bar Dam in the tailwater.

Mollusks Five protected mollusk species have been reported from Watts Bar Reservoir and its tributaries but have not been found in the study area within the last thirty years. These include the Alabama lampmussel (*Lampsilis virescens*), Dromedary pearlymussel (*Dromus dromas*), fine-rayed pigtoe (*Fusconaia cuneolus*), purple bean (*Villosa perpurpurea*), and Anthony's river snail (*Athearnia anthonyi*). These species were prevalent before the impoundment of the reservoir (about 1941) and have likely been extirpated because of the loss of suitable habitat.

Four endangered mussel species have been observed relatively recently in Watts Bar Reservoir. These include the pink mucket (*Lampsilis abrupta*), rough pigtoe (*Pleurobema plenum*), fanshell (*Cyprogenia stegaria)*, and the orange-foot pimpleback (*Plethobasus cooperianus*). These mussels are found within the waters of Watts Bar Reservoir but not in tributary steams including TVA lands associated with the proposed land plan.

Six mussel species occur just downstream of Watts Bar Dam in the tailwater. These include the four mussel species mentioned to occur in the reservoir, as well as the state- and federal endangered Dromedary pearlymussel (Dromus dromas), and the state- in need of management pyramid pigtoe (*Pleurobema rubrum*).

3.4. Managed Areas and Sensitive Ecological Sites

Managed areas and ecologically significant sites are lands set aside for a particular management objective or lands that are known to contain sensitive biological, cultural, or scenic resources. Such areas and sites within the seven-state TVA region are identified and recorded in the TVA Natural Heritage database. Managed areas and ecologically significant sites are typically established and managed to achieve one or more of the following objectives.

Species/Habitat Protection for places with endangered or threatened plants or animals, unique natural habitats, or habitats for valued fish or wildlife populations. Examples include national and state wildlife refuges, mussel sanctuaries, TVA's habitat protection areas, refuges operated by non-governmental agencies, and identified but unprotected ecologically significant sites.

Recreation areas, such as; parks, picnic areas, camping areas, trails, greenways, and other sites managed for outdoor recreation or open space, such as national parks, national recreation trails, scout camps, and county and municipal parks.

Resource Production/Harvest on lands managed for production of forest products or for hunting or fishing, such as national forests, state game lands, and fish hatcheries.

Scientific/Educational Resources on lands protected for scientific research and education, including biosphere reserves, TVA's ecological study areas, environmental education areas, and research parks.

Cultural Resources protection, such as, lands with human-made resources of interest, including military reservations, state historic areas, and state archeological areas.

Visual/Aesthetic Resources areas with exceptional scenic qualities or views, such as TVA's small wild areas, national and state scenic trails, wildlife observation areas, and wild and scenic rivers.

Most managed areas and ecologically significant sites have multiple management objectives. If management objectives cannot be met, the integrity of the area may be lost or compromised.

The managed areas and ecologically significant sites addressed in this section have been established by various agencies for numerous and often overlapping objectives. Federal agencies manage areas according to agency policy. TVA, for example, manages small wild areas (SWAs), habitat protection areas (HPAs), and ecological study areas (ESAs). Federal lands, such as National Wildlife Refuges (NWRs) and several National Forests, are managed with public funds by various agencies within the Department of the Interior and the Department of Agriculture, in accordance with applicable laws and regulations.

State laws and regulations permit state agencies, commissions, departments, and divisions to establish and manage a variety of public sanctuaries, parks and forests, and wildlife management areas (WMAs), such as the Watts Bar and Oak Ridge WMAs. City and county governments, through their parks and recreation divisions or their equivalent, serve to provide passive recreational opportunities for the public through management of municipal parks, watersheds, and picnic areas. Various nongovernmental organizations often use private donations to purchase and maintain lands for protection of sensitive resources and passive recreational activities. Some lands, such as Browder Woods, are privately owned.

For this study, managed areas and ecologically significant sites within and in the vicinity of Watts Bar Reservation were identified using the TVA Natural Heritage database and the Watts Bar Reservoir Land Management Plan Allocation maps. A total of 27 managed areas were identified and are described below *(by type and in order of parcel number as available)*.

3.4.1. TVA Small Wild Areas (SWA)

Two SWAs are located on the Watts Bar Reservation. SWAs are designated areas that have exceptional natural, scenic, or aesthetic qualities and are suitable for low-impact public use.

Fooshee TVA SWA (Parcel No. 8) is located at Tennessee River Mile (TRM) 538.4 to TRM 537.7 on the left descending shoreline. This 182-acre area on the east side of a large peninsula boasts a dry ridge forest of large white oaks and shagbark hickories. Brown Hollow, on the western edge of the area, is a moist forest of beeches and maples with a ground cover of ferns and wildflowers. The peninsula provides habitat for wintering bald eagles and numerous other migratory birds, offering visitors a unique wildlife viewing opportunity. An unmarked path and several logging roads create a network of trails that extend onto adjacent TVA lands. TVA, in cooperation with the National Wild Turkey

Federation, manages these adjacent lands to enhance habitat for wild turkeys and other wildlife. The majority of the SWA and adjacent lands are open for hunting during statewide seasons. The area is accessible by both car and boat. The trail starts in a developed campground where 55 sites are available for overnight visits. A day-use area features a beach, playground, picnic pavilions, and a boat ramp.

Whites Creek TVA SWA *(*Parcel 238*)* is located on Whites Creek at RM 2.5 to RM 2.0 on the right descending shoreline. This 171-acre area is composed of dry sawback ridgetops with stands of pine and chestnut oak. Moist coves of beech and maples can be found at lower elevations. This area is noted for spring wildflower displays including trout lily, doll's eyes, and wild ginger. An adjacent TWRA boat ramp provides access to the area. This ramp also marks the beginning of a three-mile loop trail, the focal point of an extensive information trail system. The proposed addition to Whites Creek TVA SWA (Parcel 237) is located on Whites Creek at approximately RM 3.75 to RM 2.75 on the right descending shoreline. The TWRA boat ramp area (Parcel 22-26) and proposed new trail will connect these two areas.

3.4.2. TVA Ecological Study Areas (ECSA)

ECSAs are areas designated for use for ecological research or environmental education. No ECSAs are currently located on the reservation. However, the upper reaches of Thief Neck Island, approximately 254 acres, was designated a TVA ECSA in the 1988 Land Plan. Until recently, the island was used for several years by Roane State Community College for environmental education and research. Because the college is no longer interested in studying the ecology of the island, the ESA designation will be removed from this land. The island is proposed to remain a Zone 3 designation.

3.4.3. TVA Habitat Protection Areas (HPAs)

Seven HPAs are located on Watts Bar Reservation. HPAs are established to protect populations of species that have been identified as either endangered or threatened in the state in which they occur or by the U.S. Fish and Wildlife Service (USFWS). Unusual or exemplary biological communities or geological features also can receive protection. Activities that could damage the ecological quality of these areas are deterred.

Marney Bluff TVA HPA (Parcel 65) is located at TRM 565.0 to TRM 564.5 on the left descending shoreline. This site consists of bluff terrain and is one of three site locations in Tennessee that provides habitat for the state-listed bush honeysuckle (*Diervilla lonicera*). The brittle stems of this plant make it susceptible to trampling and breakage.

Marble Bluff TVA HPA (Parcel 91*)* is located at TRM 577.7 to TRM 578.5 on the left descending shoreline. This 17-acre narrow tract has a high limestone bluff that provides habitat for false foxglove (*Aureolaria patula*), which is a state-listed threatened plant species. This site also contains Marble Bluff Cave that supports a summer colony of federally listed gray bats *(Myotis grisescens)* and possibly state-listed Tennessee cave salamanders *(Gyrinophilus palluecus).*

Polecat Creek Slopes TVA HPA (Parcel 94) is located at TRM 579.5 to TRM 579.0 on the left descending shoreline. This 8.9-acre site provides habitat for false foxglove, a state-listed threatened plant species.

Grassy Creek TVA HPA (Parcel 146) is located on Grassy Creek at CRM 14.5 on the right descending shoreline. This 99-acre tract provides potential habitat suitable for false foxglove and Appalachian bugbane (*Cimicifuga rubifolia*), both state-listed threatened species.

Sugar Grove TVA HPA (Parcel 152) is located on Emory River at ERM 1.4 to ERM 0.0 on the left descending shoreline. This 6.4-acre area provides habitat for false foxglove and smoothleaf honeysuckle (*Lonicera dioica*).

Rayburn Bridge TVA HPA (Parcel 194) located on the Clinch River at CRM 2.5 to CRM 2.2 on the right descending bank, is an 8.6-acre site under the bridges of I-40 and US 70. It provides habitat for false foxglove.

Stowe Bluff TVA HPA (Parcel 196) is located on the Clinch River at CRM 1.7 to CRM 1.0 on the right descending shoreline. This 11.4-acre site provides habitat for Appalachian bugbane, bush honeysuckle, and false foxglove.

3.4.4. Wildlife Management Areas (WMAs), Wildlife Refuges, and Wildlife Observation Areas (WOAs)

Two WMAs, two wildlife refuges, and one WOA are on the reservation. The Tennessee Wildlife Resources Agency (TWRA) manages WMAs for hunting and trapping and manages refuges primarily to support migratory and resident waterfowl and other birds, although some hunting is allowed. WOAs provide areas specifically designated for public viewing and photographing of wildlife.

Watts Bar Wildlife Management Area (WMA) consists of two units, the Thief Neck Island Unit (Parcel No. 46) and the Long Island Unit (Parcel 78), and several unnamed tracts scattered throughout the reservation (Parcels 7, 35, 50, 72, 227, 254, 276, and 286). The Watts Bar State WMA totals almost 3,900 acres. The Thief Neck Island Unit is located on Thief Neck Island at TRM 556 to TRM 551 in mid-channel. It is one of two WMA units on Watts Bar Reservoir. TWRA Region III manages approximately 25 acres on the northern tip of Thief Neck Island to enhance wildlife, annually planting small grain crops. Hunting is allowed on the entire island, with special restrictions on the manner and means of harvest. The Long Island Unit is located on Long Island between TRM 571 and 572.2 in mid channel. TWRA Region III administers hunting in this area according to statewide and some special hunting seasons. Small and big game and waterfowl hunting opportunities include squirrel, raccoon, opossum, quail, rabbit, woodcock, snipe, dove, and deer. Trapping also is allowed on this unit except during duck season.

Paint Rock State Wildlife Refuge (Parcel 88) is located at TRM 575.8 to TRM 573.8 on the left and right descending shorelines, in mid-channel, and includes embayments on several creeks. The refuge is managed by TWRA Region III to attract and support migratory and resident waterfowl, osprey, bald eagles, sandhill cranes, and numerous other wading birds. Beaver, raccoon, white-tailed deer, and other mammals also inhabit the area. During a winter closure period, public access is limited. TWRA opens this 1,600-acre area to early Canada goose and wood duck/teal hunts.

Kingston Fossil Plant Wildlife Observation Area (Parcel 190) is situated near the confluence of the Clinch and Emory rivers from ERM 3.0 to ERM 1.9 on the right descending shoreline. The Kingston Steam Plant's ash settling ponds provide habitat for a wide variety of shorebirds, wading birds, and waterfowl. It is managed by TVA in cooperation with TWRA.

Kingston Refuge is located on the Clinch River at CRM 4.4 to CRM 2.5 and on the Emory River at ERM 2.0 to ERM 0.0 on the right descending shoreline. Although the refuge encompasses the entire 1,300-acre Kingston Steam Plant site, TWRA only actively manages a 300-acre area on the peninsula between the rivers. TWRA regulations create a refuge for migrating waterfowl; however, limited hunting opportunities exist. The refuge also is a popular area for bird watchers where the brown-headed nuthatch is a species of particular interest.

Oak Ridge State WMA, located at CRM 18.8 to 14.5 on the right descending shoreline, is a 37,000-acre area primarily on the ORR and adjacent USDOE lands. TWRA administers special shotgun, muzzleloader, and archery deer hunts. Boat access is limited in the section of the WMA adjacent to the Clinch River. The WMA includes some of the adjacent TVA lands at the former Clinch River Breeder Reactor site.

3.4.5. Parks

Seven municipal or county parks are on the reservation.

Meigs County Park (Parcel 5), located at TRM 531.5 to TRM 530.5 on the left descending shoreline, is a 249-acre park managed by Meigs County under a recreation easement from TVA. The park features tennis courts, playgrounds, ball fields, an informal camping area and a natural boat ramp for lake access.

Steekee Creek Park (Parcel 99) is located between TRM 592 and TRM 591 on the left descending shoreline. TVA granted an easement to the City of Loudon for this municipal park.

Southwest Point Park (Parcel 121) is located at TRM 568.4 to 568.2 on the right descending shoreline. Atop a hill overlooking Watts Bar Reservoir, Fort Southwest Point is the only fort in the state of Tennessee reconstructed on its original foundation. Completed sections of the fort, dating from 1972, include barracks, a blockhouse, and 250 feet of palisade wall. A separate building houses a welcome center and museum, which are open from late March to mid-December. In addition to the fort, the 30-acre park includes several ball fields, a track, picnic tables, and a pavilion. A walking trail around the base of the fort connects other waterfront areas in the City of Kingston to the park. Visitors can access the area from the water via a boat ramp located on this trail. This site was transferred to the City of Kingston by TVA after archeological studies were completed in cooperation with the Tennessee Department of Environment and Conservation. The site is listed on the National Register of Historic Places.

Kingston City Park (Parcel 121) is located at CRM 2.5 on the left descending shoreline. This municipal park has been a popular gathering place for the community of Kingston since its transfer from TVA in 1958. Fishing tournaments and boat races are two of the many recreational activities at the park, which features floating boat docks, boat ramps, a pier, a roped-off swimming area, sand volleyball court, and playground equipment. Picnicking along the river bank is an especially popular activity here. Visitors also can enjoy observing bird life, including osprey, gulls, wading birds, and waterfowl, from one of the many benches provided along a waterfront walking trail. This trail, used extensively by the public, begins at the adjacent Byrd Field, passes through Kingston City Park and extends for nearly two and three-quarters miles to Southwest Point Park.

Roane County Park (Parcel 201) is located at TRM 562.3 at Caney Creek. In 1961, TVA transferred this 183-acre area, spanning two peninsulas, to Roane County for public recreation use. The large peninsula offers many recreational opportunities including a marina, campground, tennis courts, swimming beach, picnic pavilion, ball fields, other amenities, and an extensive trail system. The smaller peninsula, with a more rugged terrain, is undeveloped. However, a primitive walking trail offers hikers the opportunity to enjoy the abundant wildflower display in the spring.

City of Rockwood Park (Parcel 219) is located at TRM 553 on King Creek. This area, roughly 50 acres of open fields with some wooded areas, was transferred by TVA to the City of Rockwood in 1951. The city park provides a boat ramp, sheltered picnic tables, and restroom facilities. Also known as Tom Fuller Memorial Park, it was named for Rockwood prominent citizen and doctor, Tom Fuller. The park has become a popular area for lake access.

Spring City Park (Parcel 270) is located approximately at PRM 5.5 on the Piney River. TVA granted an easement to the town of Spring City for public recreation.

3.4.6. Other Managed Areas

Three Protection Planning Sites (PPSs), two Potential National Natural Landmarks (PNNLs), and one biosphere reserve are on or adjacent to the reservation. PPS (Protection Planning Sites) are compiled by the Tennessee Protection Planning Committee, a cooperative effort of government land managers and private individuals knowledgeable about the biota of the state. The National Natural Landmark program was established in the 1970s by the U.S. National Park Service to identify nationally significant examples of ecologically pristine or near pristine landscapes. PNNL tracts, while meeting the criteria for listing, have not to date been registered as an NNL. Biosphere reserves are areas of terrestrial and coastal ecosystems that are internationally recognized within the framework of the United Nations Education, Scientific, and Cultural Organization Man and the Biosphere (MAB) Program.

Berry Cave Protection Planning Site (PPS) is adjacent to Marble Bluff HPA (Parcel 91) and approximately 0.25 mile west of the reservoir at TRM 578.5 on the left descending shoreline. The cave at this site is home to the Tennessee cave salamander (*Gyrinophilus palleucus*).

Browder Woods PPS and Potential National Natural Landmark (PNNL) is located approximately 0.45 mile north of the reservoir at TRM 597.0 on the right descending shoreline. This privately-owned site contains approximately 300 rolling acres of second growth white oak forest, a rare remnant of the white oak forest which was once widespread in the Great Valley.

Crowder Cemetery Cedar Barrens PPS is located on the Clinch River at CRM 12.9 to CRM 12.4 on the left descending shoreline. It extends southwest from the river. This 258-acre tract was designated a protection planning site by the Tennessee Protection Planning Committee. The cedar barrens at one time contained a number of rare plants including cylindric blazing star (*Liatris cylindracea*), goldenrod (*Solidago ptamicoides*), tall larkspur *(Delphinium exaltatum*), and earleaf foxglove (*Agalinis auriculata*). Recent ground disturbance has likely reduced the number of rare plants found in this area to two: the goldenrod and a state-listed special concern species, the naked-steam sunflower (*Helianthus occidentalis)*. This area was once a part of the Oak Ridge Reservation (ORR).

Oak Ridge National Laboratory Reservation (ORNL) and PNNL is adjacent to the reservoir and is located on the Clinch River at CRM 23.2 to CRM 18.9. It excludes the former Clinch River Breeder Reactor site. USDOE manages this 34,000-acre area, which is used variously for manufacture, laboratory research, managed forest, and ecosystem process research.

Oak Ridge National Environmental Research Park Biosphere Reserve is an area adjacent to the reservoir and contains many natural areas, sensitive sites, and research plots. This area contains approximately 20,000 acres and is within the boundaries of the ORR. The park is used as an outdoor laboratory for studying present and future environmental consequences from energy-related issues. It provides protected land for the use of education and research in environmental sciences. Managed by ORNL for the USDOE, it is located on the Clinch River at CRM 21.0 to CRM 18.9 and on Melton Hill Reservoir CRM 33.2 to CRM 23.0 on the right descending shoreline.

3.4.7. NRI-listed Streams

The Nationwide Rivers Inventory (NRI) listing by the National Park Service was used to identify NRI-listed streams in the vicinity of the reservation; three such river segments were identified and are described below. Approximately 3,400 free-flowing river segments in the United States are listed on the NRI, which were so designated for their nationally significant natural or cultural values.

Emory River, from ERM 14 at the Roane County line to ERM 25 one mile below the Nemo Bridge, is listed on the Nationwide Rivers Inventory. The National Park Service recognizes this 11-mile segment for its scenic, recreational, geologic, and fish and wildlife values. It is noted as a scenic pastoral stream that flow through an impressive gorge area. It also supports game fishery. The segment ERM 25 to ERM 27 is a designated component of the National Wild and Scenic Rivers System. The Emory River meets the Obed River, Tennessee's only designated National Wild and Scenic River, at ERM 27.

Little Tennessee River, from LTRM 1.0 above Tellico Dam to LTRM 33.0 at Chilhowee Dam, is listed on the Nationwide Rivers Inventory. The National Park Service recognizes this 32-mile segment for its scenic, recreational, geologic, and fish and wildlife, historic, and cultural values. It is noted as critical habitat for the federally listed snail darter *(Percina tanasi)*, offers excellent fishing and floating opportunities, and has 180 recorded archaeological sites.

Piney Creek, from PCRM 9.0 at the confluence with Little Piney Creek north of Spring City to PCRM 32.0 at the headwaters near the Bledsoe County line, is listed on the Nationwide Rivers Inventory. The National Park Service recognizes this 23-mile segment for its scenic, recreational, and geologic values. It is noted as one of the most wild, scenic, and clear streams in Tennessee. It features adjacent waterfalls and affords an exciting river run.

3.5. Water Quality and Shoreline

Watts Bar is a mainstem Tennessee River reservoir with an average annual discharge of about 27,000 cubic feet per minute (cfs), average water residence time of 18 days, and a winter drawdown of about 6 feet from the summer pool level. Only 1,834 square miles of total 17,310 miles of the watershed drains directly into Watts Bar Reservoir. Most of the water entering Watts Bar Reservoir (86 percent) comes from outside the immediate

drainage area. The Tennessee and Little Tennessee rivers (i.e., discharge from Fort Loudoun Dam, 18,200 cfs) account for approximately 67 percent of the flow into the reservoir. The Clinch River (i.e., discharge from Melton Hill Dam, 5,000 cfs) accounts for about 19 percent of the flow into the reservoir. The remaining 14 percent is contributed by local inflows.

There are five major tributaries, greater than 100 square mile drainage area, that make up the majority of the local inflow to Watts Bar Reservoir: Poplar Creek (136 square mile drainage area) joins the Clinch River at CRM 12; the Emory River (865 square mile drainage area) joins the Clinch River at CRM 4, near the city of Kingston; White's Creek (138 square mile drainage area) joins the Tennessee River at TRM 545; and the Piney River (137 square mile drainage area) enters the Tennessee River at TRM 532, near Spring City. The Little Tennessee River (2,630 square mile drainage area) joins the Tennessee River at TRM 601 below Tellico Dam, but very little water is discharged through Tellico Dam. Instead it is routed through a navigation canal to Fort Loudoun Reservoir and is controlled primarily by Fort Loudoun Dam and Navigation Lock.

Hydrologic Unit Codes (HUCs) are cataloging units assigned to each watershed by the U.S. Geological Survey for the purpose of assessment and management activities. HUCs are a standard units used by most state and federal agencies to reference for scientific study, sampling, and impact analysis. They are important to water quality efforts as they define land areas that drain to a specific stream. HUCs are based on watershed size ranging from two digit regional watershed codes (major rivers) to 12-digit cataloging units (creeks and streams) that represent the smaller sub-watersheds. The 1,834 square mile local Watts Bar Reservoir watershed is comprised of three regional cataloging units: 06010201 for the Watts Bar Reservoir; 06010208 for the Emory and Obed River system; and portions of 06010207 for the Clinch River Tributaries that are part of Watts Bar Reservoir. This immediate drainage area contains a total of 31 smaller, 11-digit sub-watersheds. Land uses can contribute positively or negatively to the water quality of the stream in that drainage basin. These smaller units of study can be used to determine causes and sources of water pollution and develop plans and projects to improve conditions. Table 3.5-1 details the hydrologic unit address of TVA parcels on Watts Bar.

Table 3.5-1. Watts Bar Reservoir Watershed 11-digit Sub-Watersheds

Hydrologic Unit	Watershed Name	County	Square Miles	TVA Parcels within the Hydrologic Unit
TN-06010201-140	Tennessee River	Loudon	56.9	97 (partial), 99
TN-06010201-150	Sweetwater Creek	Loudon	62.2	-
TN-06010201-160	Tennessee River	Roane	52.5	88 (partial), 89 through 94, 95 (partial), 97 (partial), 98, 100 through 111.
TN-06010201-170	Pond Creek	Loudon	36.7	95 (partial), 96, 12-69
TN-06010201-180	Paint Creek	Roane	31.1	-
TN-06010201-190	Tennessee River	Roane	55.6	Portions of 68 and 69, 70 through 87, 88 (partial), 112 through 120, 121 (partial), 12-41, 12-43, 12-56, 12-57, 12-59, 12-60, 12-62.
TN-06010201-200	Tennessee River	Roane	92.3	Portion of 34 and 35, 36 through 66, portions of 68 and 69, 195 (partial), 197 through 224, 225

Hydrologic Unit	Watershed Name	County	Square Miles	TVA Parcels within the Hydrologic Unit
				(partial), 226, 227, 12-13, 12-20, 12-22, 12-23, 12-24, 12-29, 12-30, 12-31, 12-32, 12-34, 12-35, 12-36, 12-37, 12-39, 12-40.
TN-06010201-210	Whites Creek	Rhea	55.1	-
TN-06010201-220	Piney Creek	Roane	62.3	-
TN-06010201-230	Whites Creek	Roane/Rhea	39.4	225 (partial), 228 through 246, 12-17, 12-18, 12-26, 12-27.
TN-06010201-240	Tennessee River	Meigs	36.5	4 (partial), 5 through 34, 35 (partial), 247 through 259, 260 (partial), 261, 289 (partial), 290 (partial), 291 through 295, 297 through 301, 12-1, 12-2, 12-3, 12-4, 12-6, 12-16.
TN-06010201-250	Piney River	Rhea	61.4	-
TN-06010201-260	Soak Creek	Rhea	32.0	-
TN-06010201-270	Piney River	Rhea	44.9	260 (partial), 262 through 289, portions of 290 and 291, 12-8.
TN-06010207-040	Clinch River	Roane	116.8	121 (partial), 122 through 150, 151 (partial), 190 (partial), 191 through 196, 12-44, 12-54, 12-55, 12-63.
TN-06010207-060	Poplar Creek	Roane	133.6	-
TN-06010208-010	Obed River	Cumberland	77.7	-
TN-06010208-020	Obed River	Morgan	92.0	-
TN-06010208-030	Daddys Creek	Cumberland	37.5	-
TN-06010208-040	Daddys Creek	Cumberland	75.0	-
TN-06010208-050	Daddys Creek	Morgan	63.8	-
TN-06010208-060	Island Creek	Morgan	21.6	-
TN-06010208-070	Clear Creek	Cumberland	65.8	-
TN-06010208-080	Clear Creek	Morgan	57.8	-
TN-06010208-090	White Creek	Morgan	50.2	-
TN-06010208-100	Emory River	Morgan	92.0	-
TN-06010208-110	Emory River	Roane	61.9	151 (partial), 152 through 155, 156 (partial), 165 (partial), 165 through 189, 190 (partial), 12-45, 12-47, 12-51, 12-53.
TN-06010208-120	Crooked Fork	Morgan	62.1	-
TN-06010208-130	Crab Orchard Creek	Morgan	46.3	-
TN-06010208-140	Clifty Creek	Morgan	20.0	-
TN-06010208-150	Little Emory River	Roane	41.0	156 (partial), 157-163, 164 (partial), 165, 12-48, 12-50.

3.5.1. General Water Quality Characteristics

The water quality in Watts Bar Reservoir is affected by many factors, such as, from TVA public land along the reservoir, and from land use practiced throughout the reservoir's drainage area. Most of the water entering Watts Bar reservoir originates outside the immediate watershed, so the overall water quality characteristics of the reservoir are

strongly affected by waters outside of local watershed. The water quality characteristics of the embayments are, however, more apt to exhibit a response to pollutant loadings and changes in land use within the local area than the main river region.

Watts Bar is considered a productive (eutrophic) reservoir with an average chlorophyll concentration for the growing season (April through September, 1998-2004) of about 15 milligrams per cubic meter ($mg/m^{3)}$ in the main channel, with embayments ranging from 10 to 35 mg/m^3 (2003, unpublished data). Summertime thermal stratification does occur but is generally limited to the downstream reach of the reservoir (TRM 530 to 545) or embayments were velocity is sufficiently reduced to limit mixing of the water column, diminishing reaeration and causing lower dissolved oxygen concentrations in the bottom waters. TVA has installed aeration equipment to add oxygen to the deep water above Watts Bar Dam and to improve conditions immediately downstream. The upstream reach above TRM 565 is essentially riverine and typically does not experience thermal stratification. Algal productivity is suppressed due greater concentration of suspended sediment and limited time in the photic zone (the area of the water column where light is sufficient for photosynthesis) for growth. The middle reach of the reservoir (TRM 545 to 565) is termed the transition zone. This segment of the river has a greater volume and a longer residence time than the upper reach, and water quality is more influenced by internal processes. Velocity is reduced, in this reach and suspended sediment begins to settle from the water column, and algae remain in the photic zone for longer periods. This allows increased photosynthesis and results in higher algal productive (i.e. higher chlorophyll concentrations). This reach of the reservoir typically experiences only weak thermal stratification except during low flow conditions.

3.5.2. TVA Water Quality Monitoring and Results

As part of the Reservoir Vital Signs Monitoring Program initiated by TVA in1990, Watts Bar Reservoir has been monitored for physical and chemical characteristics of waters, sediment contaminants, benthic macroinvertebrates (bottom dwelling animals living in or on the sediments such as worms, mollusks insects, and snails) and fish community assemblage. Five key indicators (dissolved oxygen (DO), chlorophyll, fish, bottom life, and sediment contaminants) are monitored and contribute to a final rating that describes the "health" and integrity of an aquatic ecosystem. TVA monitors two locations on Watts Bar Reservoir for physical and chemical characteristics, and sediment contaminants. The forebay region (the deep, still waters near the dam) is sampled at TRM 532.5. The mid-reservoir region (or transition zone) is sampled at TRM 560.8, downstream of the confluence of the Clinch and Tennessee Rivers. Other components of the monitoring program include monitoring of toxic contaminants in fish flesh to determine their suitability for consumption, and sampling of bacteriological concentrations at recreational areas to evaluate their suitability for water contact recreation (TVA, 2004).

The overall Reservoir Ecological Health rating for Watts Bar Reservoir was fair in 2004. Ratings declined from good to poor between 1994 and 2002. This was driven mostly by declining scores for chlorophyll and DO (see Table 3.5-2). In reservoirs such as Watts Bar, which have short water residence time (the amount of time required to replace the reservoirs volume of water with “new” water), DO and chlorophyll can be strongly influenced by reservoir flow. The drought-like condition across the Valley from mid-1998 to mid-2002 led to lower flows, thereby allowing for more stagnant conditions and lower DO concentration in bottom waters. The improved rainfall and runoff in 2003 and 2004 greatly improved DO. However, chlorophyll concentrations have continued to show a trend of

increasing concentrations (Figure 3.5-1 and 3.5-2) during the last 14 years, with substantial increases at TRM 560.8. These high chlorophyll concentrations have caused the water quality ratings to decrease. Analysis of the total phosphorus data also indicates a trend of increasing concentrations at TRM 560.8. Nitrogen concentrations have been more variable and exhibit no strong trend over time.

Table 3.5-2. Watts Bar Reservoir Water Quality Ratings, Reservoir Vital Signs Monitoring Data

	Monitoring Years					
	1994	**1996**	**1998**	**2000**	**2002**	**2004**
Watts Bar Forebay						
Dissolved Oxygen	Fair	Good	Good	Poor	Poor	Good
Chlorophyll	Fair	Poor	Poor	Poor	Poor	Poor
Sediment	Fair	Fair	Fair	Fair	Fair	Good
Watts Bar Mid-Reservoir						
Dissolved Oxygen	Good	Good	Good	Good	Good	Good
Chlorophyll	Good	Poor	Poor	Poor	Poor	Poor
Sediment	Fair	Fair	Fair	Fair	Fair	Fair

4

Figure 3.5-1. Trend in Chlorophyll-a Concentrations in Watts Bar Reservoir Forebay (TRM 532.5)

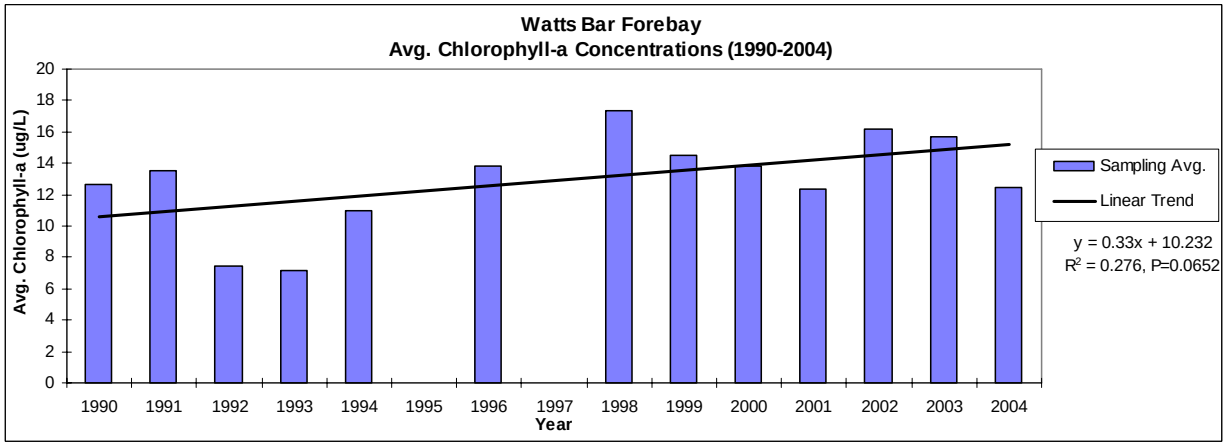
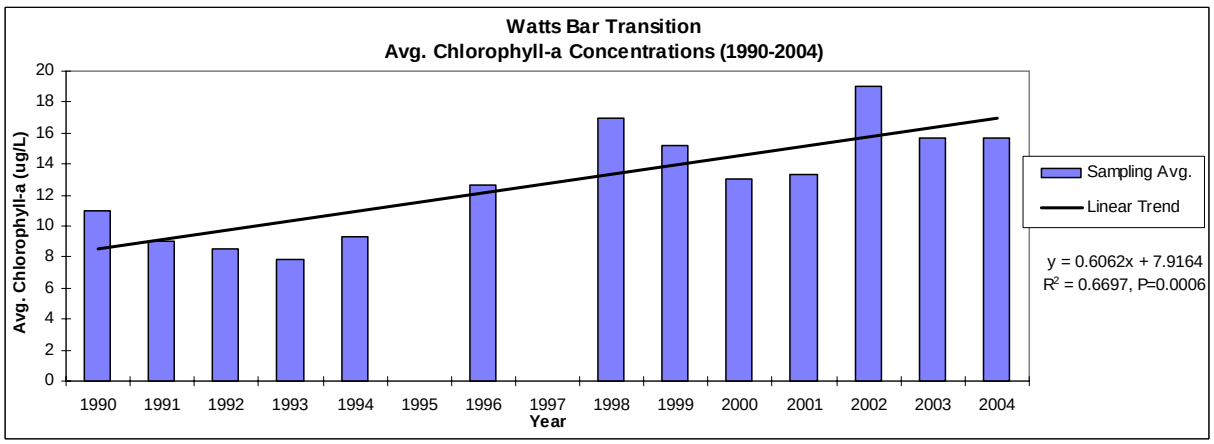


Figure 3.5-2. Trend in Chlorophyll-a Concentrations in Watts Bar Reservoir Transition Zone (TRM 560.8)



Sediment quality rated good at the forebay and fair at the transition due to elevated arsenic levels. The sediment quality ratings have varied from good to fair (1991-2003) with a greater frequency of occurrence of organic chemicals (mainly polychlorinated biphenyls (PCBs) and chlordane) in recent years. PCBs and chlordane were not detected in 2004. The presence or absence of these chemicals is probably more due to sampling variability rather than an actual increase because of their historical, rather than current use. These chemicals are no longer manufactured because they have been linked to a variety of health concerns. Chlordane was mainly used to control termites. PCBs were commonly used in a variety of commercial products, including adhesives, hydraulic systems, transformers, electric motors, and other electrical equipment, as well as during past operations of the USDOE's Oak Ridge Reservation.

Institutional controls (warning signs, fish consumption advisories, and monitoring) are in place to reduce health and environmental risk. USDOE is required to take appropriate actions if a sediments disturbing activity would threaten human health or the environment. The land planning process will not affect the established procedure for reviewing projects and proposals which may result in sediment disturbance. TVA participates in the Watts Bar Interagency Working Group along with the US Army Corps of Engineers, the USDOE, TDEC, and the US Environmental Protection Agency (USEPA). The primary purpose of this working group is to review projects that have the potential to disturb contaminated or potentially contaminated sediments resulting from past operations at the Oak Ridge Reservation.

The state of Tennessee has issued several fish consumption advisories for Watts Bar Reservoir because of PCB contamination. Striped bass, catfish, and striped bass-white bass hybrids caught in the Tennessee River portion of the reservoir should not be eaten. Additionally, no fish caught in the Poplar Creek Embayment should be eaten due to PCB and mercury contamination.

There is a precautionary advisory for largemouth bass, white bass, sauger, carp, and smallmouth buffalo caught in the Tennessee River portion of the reservoir and catfish and sauger caught in the Clinch River arm. A precautionary advisory means pregnant women, nursing mothers, and children should not consume the fish species named, and all other individuals should limit consumption to no more than one meal per month. PCB concentrations have declined in fish tissue samples from Watts Bar and neighboring Fort Loudoun and Tellico reservoirs in recent years. To better understand the issue of PCB contamination, TVA coordinates with state agencies to sample these reservoirs annually.

There are no state advisories against swimming in Watts Bar Reservoir. *E. coli* bacteria levels were tested in samples collected on and around the reservoir in 2004. The following sites were within the state of Tennessee's guidelines for water contact: Watts Bar Dam Recreation Area beach, Fooshee Pass Day Use Area beach, Euchee Marina beach, Campground on the Lakeshore beach, Hornsby Hollow Campground beach, Red Cloud Campground beach, Eden on Lake beach, Brigadoon Resort beach, Whites Creek boat ramp, Bayside Marina beach, KOA Campground and Marina boat ramp, Roane County Park beach, Kingston City Park beach, Camp Buck Toms swim area.

Several sites exceeded the single-sample maximum at least one time. Some of the elevated *E. coli* concentrations found at these sites may be related to documented

waterfowl presence or collection following a rainfall event. These sites were Lakeside Resort beach, Arrowhead Resort beach, Blue Springs marina, Riley Creek Day Use Area beach, Riley Creek Campground beach, Caney Creek informal swimming area, Spring City Park boat ramp.

The 303(d) List is a compilation of the streams and lakes in Tennessee that are "water quality limited" or are expected to exceed water quality standards in the next two years and need additional pollution controls. The assessment of Tennessee's waters was based on a water quality evaluation that took place during 2003 and early 2004 (TDEC, 2004)

Water quality limited streams are those that have one or more properties that violate water quality standards. They are considered impaired by pollution and not fully meeting designated uses (TDEC, 2004). Of the 31 smaller 11-digit watersheds, or HUCs, that make up the local Watts Bar Reservoir Watershed, there are 19 that have impaired stream segments. The impaired segment, corresponding hydrologic unit and cause and source of impairment are listed in Appendix C, Table C-2.

3.6. Aquatic Ecology

Aquatic habitat in the littoral (near shore) zone is greatly influenced by underwater topography and backlying land use. Underwater topography at Watts Bar Reservoir varies from moderately steep, with scattered small bluffs near the river channel, to typically shallow in embayments, coves, and areas further from the river channel and tributary stream channels. Undeveloped shoreline is mostly wooded, so fallen trees and brush provide woody cover in those areas. Woody habitat is usually reduced on TVA and non-TVA lands where backlying property is largely residential or agricultural.

As part of the data collection effort for the SMI EIS, a survey was conducted on four representative TVA reservoirs by TVA to arrive at a shoreline aquatic habitat index (SAHI) score which would indicate the quality of aquatic habitat conditions adjacent to various land uses. Although Watts Bar was not chosen as one of the four reservoirs, nearby Fort Loudoun was included in the surveys. Scoring parameters (metrics) included seven physical habitat parameters (i.e., riparian zone condition, amount of canopy cover, bank stability, substrate composition, amount of cover, habitat diversity, and degree of slope) important to Tennessee Valley reservoir resident sport fish populations which rely heavily on shoreline areas for reproductive success, juvenile development, and/or adult feeding. Field methods and the SAHI rationale are described in Appendix G of the SMI Final EIS (TVA, 1998). The overall average SAHI score extrapolated for all TVA reservoirs was 24.3 (of a possible 35), which indicates generally "fair" shoreline aquatic habitat within the reservoirs. Average SAHI scores are higher adjacent to lands currently allocated for Natural and Wildlife uses and Cultural/Public Use/Open Area uses, compared to shorelines adjacent to all other allocated uses.

Rock is an important constituent of littoral aquatic habitat over much of the reservoir, either in the form of bedrock outcrops or a mixture of rubble and cobble on steeper shorelines or gravel along shallower shorelines. Substrate and available aquatic habitat in coves and embayments also typically correspond to shoreline topography and vegetation. In areas characterized by residential development, habitat includes man-made features such as shoreline stabilization structures (e.g., seawalls or riprap) and docks. Some aquatic habitats such as, fallen trees are less numerous in residential areas.

TVA began a program to systematically monitor the ecological conditions of its reservoirs in 1990. Previously, reservoir studies had been confined to assessments to meet specific needs as they arose. Reservoir (and stream) monitoring programs were combined with TVA's fish tissue and bacteriological studies to form an integrated Vital Signs Monitoring Program. The following descriptions of Watts Bar Reservoir's existing condition are based primarily on results from this program. Due to sampling methodology and rating criteria changes, only data collected since 1994 are presented.

3.6.1. Benthic Community

Benthic macroinvertebrate (e.g., lake bottom-dwelling, readily-visible, aquatic worms, snails, crayfish, and mussels) samples were taken in four areas of Watts Bar Reservoir during even numbered years beginning in 1994, as part of TVA's Reservoir Vital Signs Monitoring Program. Areas sampled included the forebay (area of the reservoir nearest the dam) at TRM 531.0, a mid-reservoir transition station at TRM 560.8, and inflows in both the Tennessee River at TRM 600 and the Clinch River at CRM 19. Forebay sampling was moved to TRM 532.5 in 2000. Bottom-dwellers are included in aquatic monitoring programs because of their importance to the aquatic food chain, and because they have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Sampling and data analysis were based on seven parameters (eight parameters prior to 1995) that indicate species diversity, abundance of selected species that are indicative of good (and poor) water quality, total abundance of all species except those indicative of poor water quality, and proportion of samples with no organisms present. Collection methods and rating criteria were different prior to 1994, so those results are not compared directly to samples taken using current methods and therefore are not presented in this document.

As shown in Table 3.6-1, the benthic community in Watts Bar Reservoir rated from poor to excellent in comparison to other run-of-the-river reservoirs. The mid-reservoir transition station had the best overall benthic community, rating fair or better each year. In 2004, the benthic community rated excellent at this station. Otherwise throughout Watts Bar Reservoir, benthic communities rated generally poor, although there may be an improving trend since 2002. Of the seven parameters used to evaluate the benthic community, two received the highest possible rating at most of the sites in 2004. Those metrics were number four and six. Metric 6 received the lowest score at three of the four sites, while the other metrics scored inconsistently.

Table 3.6-1 Benthic Community Ratings, Vital Signs Monitoring Data

	Monitoring Years					
Station	**1994**	**1996**	**1998**	**2000**	**2002**	**2004**
Forebay	Poor	Very Poor	Poor	Poor	Poor	Fair
Mid-reservoir	Good	Fair	Fair	Fair	Fair	Excellent
Inflow (Tennessee River)	Poor	Poor	Poor	Poor	Poor	Fair
Inflow (Clinch River)	Poor	Poor	Poor	Poor	Fair	Fair

3.6.2. Fish Community

The Reservoir Vital Signs Monitoring Program included annual fish sampling at Watts Bar Reservoir in even numbered years from 1994 through 2004. The electro-fishing and gill netting sampling stations correspond to those described for benthic sampling.

Fish are included in aquatic monitoring programs because they are important to the aquatic food chain and because they have a long life cycle which allows them to reflect conditions over time. Fish are also important to the public for aesthetic, recreational, and commercial reasons. Monitoring results for each sampling station are analyzed to arrive at a Reservoir Fish Assemblage Index (RFAI) rating which are based primarily on fish community structure and function. Also considered in the rating is the percentage of the sample represented by omnivores and insectivores, overall number of fish collected, and the occurrence of fish with anomalies such as diseases, lesions, parasites, deformities, etc. (TVA, 1997).

The vital stations fish community monitoring results are shown in Table 3.6 -2. This data compares Watts Bar to other run-of-the-river reservoirs. With only two exceptions since 1994, fish communities have rated 'good' in Watts Bar Reservoir. This indicates a consistently well-balanced fish assemblage over time. In 2004 sampling, overall species diversity was good, as were the diversity of top carnivores, and the low incidence of anomalies. Lower ratings were seen in percent tolerant individuals, percent of omnivores.

Table 3.6-2 Fish Community Ratings, Vital Signs Monitoring Data

	Monitoring Years					
Station	**1994**	**1996**	**1998**	**2000**	**2002**	**2004**
Forebay	good	good	good	good	fair	good
Mid-reservoir	good	good	good	good	fair	good
Inflow (Tennessee River)	good	good	good	good	good	good
Inflow (Clinch River)	good	good	fair	good	good	fair

A total of 43 fish species was collected in TVA's most recent fish collections at Watts Bar Reservoir in the fall of 2004. More abundant species in the overall sample were gizzard shad, bluegill, redear sunfish, largemouth bass, and freshwater drum.

TWRA creel data indicate that bluegill is the species caught in highest numbers, with largemouth bass trailing closely behind (TWRA 2002). Black bass are, however, the most sought after group of fish by Watts Bar Anglers, as nearly 330,000 hours were spent in pursuit of them in 2000. This was nearly one-half of all the estimated fishing pressure for Watts Bar that year. Other species caught in considerable numbers include black crappie, white bass, white crappie, smallmouth bass, and sauger.

In 1995 TDEC recommended that the public not consume catfish and striped bass, as well as limiting consumption of largemouth bass from the Lower Watts Bar Reservoir. Similar advisories associated with PCBs are in effect for other East Tennessee lakes, including Fort Loudon, Tellico, and Melton Hill Lake--all of which are upstream from Watts Bar (USDOE, 1995). Currently TDEC advises the public to not consume catfish, striped bass, and hybrid striped bass from Watts Bar Reservoir, with precautionary advisories on eating white bass, sauger, carp, smallmouth buffalo, and largemouth bass (TDEC, 2002).

3.7. Wetlands and Floodplains

Floodplains and most wetlands by their nature can occur on the same TVA property, that is, lowland areas next to water courses, and are included together in a single section of the EIS as a convenience to readers and analysis. Both wetlands and floodplains are important to the function of TVA's management of the Tennessee River including Watts Bar Reservoir Lands. The occurrence of wetlands and floodplains can influence the management of TVA property and the activities which can take place there.

3.7.1. Wetlands

Wetlands are defined by TVA Environmental Review Procedures (TVA 1983) as: "Those areas inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstance, do or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, mud flats, and natural ponds."

Wetlands are typically transitional ecosystems between terrestrial and aquatic communities. Watts Bar Reservoir is located in the Ridge and Valley physiographic province. Wetlands in this region are typically associated with low-lying, poorly drained areas, or linear in feature and associated with the floodplain areas of streams, rivers, and in the case of the Watts Bar project, reservoirs. In the Watts Bar project area; wetlands represent a small percentage of the landscape relative to uplands, mainly due to the geology of the region (Hefner et al. 1994).

Watts Bar Reservoir wetlands were identified and classified using the U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) mapping conventions and the system developed by Cowardin et al (1979).

Wetlands occurring in Watts Bar Reservoir and its tributaries are in the Palustrine system (P), and the forested (FO), scrub-shrub (SS), emergent (EM), and aquatic bed (AB) subsystems. In the forested and scrub-shrub wetlands, the vegetation class is "broad-leaved deciduous", which is designated by the number 1. In the emergent wetlands, the vegetation class is "persistent", designated by the number 1, and "non-persistent", designated by the number 2. The term "persistent" refers to herbaceous vegetation with aboveground parts that persist through the non-growing season, such as, for example, the dry remains of cattail and sedges. "Non-persistent" vegetation dies back completely to ground level during the non-growing season. The hydrologic regimes in these wetlands were judged to include temporarily flooded (A), and seasonally flooded (C), although it is possible that other hydrologic regimes, such as saturated (B) and semi-permanently flooded (F) occur.

The functions of wetlands associated with Watts Bar Reservoir include shoreline stabilization, retention of sediments; removal or transformation of contaminants, nutrient cycling, provision of fish and wildlife habitat, and provision of plant species and community diversity. A brief description of wetland functions follows:

Shoreline stabilization: The roots of trees, shrubs, and herbaceous vegetation, and the organic litter layer on the ground, help to stabilize the shoreline soil against erosion that could result from boat wakes and storm runoff. This function is important throughout the reservoir, but is particularly important to preserve in those areas along the main shoreline

which are subject to wave action from boat wakes and increased runoff from developed areas.

Retention of sediments: Vegetation and the litter layer in the wetlands aid in the removal and retention of eroded soil and particulates that wash toward the reservoir from adjacent upland areas and in tributary streams. This function is particularly important to preserve in those areas in which surrounding land uses could result in increased erosion and runoff, including farming operations and land development.

Retention and transformation of contaminants and nutrients: Contaminants and nutrients in dissolved and particulate form can be carried into the reservoir in storm runoff. Potential contaminants could include fertilizers and pesticides from agricultural, residential, and urban areas, excess nutrients and pathogenic bacteria from animal waste and septic system leachate, and oil and grease from roads and watercraft. Through various chemical, biological, and physical means in wetland soils, these contaminants and nutrients can be sequestered, transformed into other chemical form, or assimilated by plants.

Nutrient cycling: Nutrients are contributed to the system internally in leaf litter, plant debris, and animal waste and remains. These nutrients are cycled internally and either taken up by plants in the wetland or exported out of the wetland.

Provision of fish and wildlife habitat: Wetlands provide habitat for a large number of mammal, bird, amphibian, reptile, fish, and invertebrate species. Wetlands are essential habitat for migratory and nesting waterfowl, and many shorebird and songbird species. Many species are wetland-dependent for a part or all of their life-cycle. Other species may not use the wetlands directly, but are dependent on wetlands as a source of carbon and energy. An example of this would be aquatic invertebrates which use the organic material exported from wetlands.

Provision of plant species and community diversity: Wetland plant communities consist primarily of species that can grow under low-oxygen, saturated soil conditions. Although some of the species can grow outside of wetlands, most cannot grow in dry situations. The destruction of wetlands results in local removal of commonly occurring species from the landscape, and thus, over time, can lead to a reduction in the amount of plant, community, and landscape diversity in the local area or region.

Flood flow alteration: Important functions of riverine wetlands are those associated with flood flow alteration. These functions include short- and long- term storage of flood waters and energy reduction. This function is also important for another wetland function, the export of organic carbon. Plant and other organic material produced in the wetland is exported out of the wetland to downstream consumers during flood events.

General trends in wetland loss in the southeast and in Tennessee indicate that palustrine forested wetlands have suffered a net loss in acreage over the last ten years, primarily due to transportation impacts, the continued growth of urban / suburban development associated with continued population growth, and to a lesser degree agriculture (Heffner et al. 1994). Prior to impoundment, the Tennessee River system had extensive areas of forested wetlands that were lost as dams were constructed and these floodplain areas were covered by water. Depending upon topography, forested wetlands have developed over time in the riparian and floodplain zones now affected by reservoir operations. Emergent and scrub-shrub wetlands have also developed in the embayments and mouths of tributary

streams as they enter the reservoir. It is these wetlands, located on TVA parcels along Watts Bar Reservoir and its tributaries, that are part of the overall resource assessment for the proposed plans.

Wetland Types and Extent
Some fieldwork was conducted for the purposes of the integrated resources management plan. However, existing data sets were used to estimate the extent and types of wetlands located in the study area. These various data sets are described below.

Reservoir Operations Study (ROS) Data analysis conducted for TVA's 2004 Reservoir Operations Study (TVA, 2004) provided acreage figures for wetland types at the reservoir level. This analysis was conducted using U.S. Fish and Wildlife Service National Wetland Inventory (NWI) data. A geographic information system (GIS) analysis was performed on this data, and then wetland loss or gain trends, as described in Dahl (2000), were applied to the figures to estimate current acreage.

Shoreline Management Inventory (SMI) The SMI wetlands data is comprised of field surveyed wetlands mapped and entered into a GIS. This data provides wetland acreage, as well as mapped locations of extremely small linear wetland areas. SMI coverage does not include aquatic bed wetlands or flats. This data includes mixed habitat types, e.g. forested/scrub shrub, scrub shrub/emergent wetlands.

Field Surveys Field surveys were conducted on a limited number of wetlands determined by TVA biologists to be especially unique or of high ecological value. These wetlands are located on Zone 3 (Sensitive Resource Management), Zone 4 (Natural Resource Conservation), Zone 6 (Recreation) and Zone 7 (Shoreline Access) parcels.

Analysis of these data sets indicates forested wetlands are the most common wetland type on Watts Bar reservoir. Emergent and scrub shrub wetlands are less common, however Watts Bar is unique in that it supports areas with a mix of habitat types – emergent and scrub shrub wetlands are often are found associated with larger areas of forested wetlands, along the shoreline gradient and in embayments across the reservoir.

Aquatic bed habitats, those areas with rooted vascular plants, are very limited on Watts Bar. There are a few shallow areas that support spiny-leaf naiad (an exotic species); aquatic bed areas were more extensive in the 1980's and very early 1990's (primarily comprised of Eurasian water milfoil). High water flows and other factors (David Webb, personal communication) in the mid-1990's eliminated most of the aquatic bed (milfoil) habitats.

While small areas of wetlands are located along the shoreline throughout the reservoir, especially significant areas of wetlands occur in the embayments associated with Hines Creek, Whites Creek, Muddy Creek, Greasy Run Creek, and Wolf Creek. Other particularly important wetland areas are located in parcels located along the Little Emory River, in the Swan Pond and Clinch River Breeder Reactor area, and on various forested islands in the mainstem of the river.

Palustrine emergent and scrub-shrub wetlands are less common, and are commonly found at the head of embayments of the smaller tributary streams as they enter the reservoir. There are significant areas of emergent and scrub shrub wetlands found in the embayments of Greasy Run Creek, Hines Creek, and Grassy Creek.

Typical plant species that comprise wetlands in the study area include red maple, sycamore, green ash, willow oak, sweetgum, box-elder, alder, river birch, rose mallow, buttonbush, silky dogwood, soft rush, smartweed, cattail, *Scirpus spp*., and rice cutgrass. Reed canary grass, an exotic species, is becoming increasingly more common, especially in the Tennessee Arm of the river upstream from Kingston.

Based on field surveys designed to assess especially unique wetland areas on Watts Bar, there are twelve areas of wetlands located on portions of Zone 7 (Shoreline Access) parcels that were determined to be of very high quality. This assessment was made using a version (TVARAM) of the *Ohio Rapid Assessment Method* (ORAM v. 5.0) specific to the TVA region. The assessment was developed to assess wetland condition/ecological significance. Using the TVARAM, eight of these wetlands scored as Category 3 wetlands, which includes wetlands of very high quality and wetlands which are of concern regionally and/or statewide, such as wetlands which provide habitat for threatened or endangered species. Four wetlands on these Zone 7 parcels scored as Category 2 wetlands, which are described as moderate quality wetlands. These areas are listed below in Table 3.7-1.

Table 3.7-1 Wetland Types on Zone 7 Parcels

Parcel[1]	Wetland Type[2]	TVA RAM Score/Category[3]	Allocation
15	PFO/PEM/PSS/flats	90/Category 3	Zone 7
36	PEM/PFO/PSS/flats	84/Category 3	Zone 7
265	Flats/PSS/PEM/PFO	78.5/Category 3	Zone 7
269	PFO/PSS/PEM/flats	74.5/Category 3	Zone 7
269	PFO/PSS/PEM/flats	76/Category 3	Zone 7
102	PFO/PSS/PEM/flats	62/Category 2	Zone 7
109	Flats/PSS/PFO/PEM	55.5/Category 3	Zone 7
112	PEM/PSS/flats	55/Category 3	Zone 7
128	PFO/PEM/PSS	71.5/Category 3	Zone 7
157	PFO/PEM/PSS/flats	64/Category 2	Zone 7
111	PFO/PEM/PSS/flats	82.5/Category 3	Zone 7
234	PEM/PSS/PFO/flats	73/Category 3	Zone 7

[1]Wetlands occupy portions of these parcels.

[2]P – palustrine; EM – emergent; SS - scrub-shrub; FO – forested; Cowardin 1979; order of wetland class is based on the dominant class in descending order of prevalence.

[3]TVARAM scoring methodology provides a maximum score of 100 points. Wetlands scoring between 67-100 are classified as Category 3 wetlands; wetlands scoring between 35-67 are Category 2 wetlands, and wetlands scoring below are Category 1 wetlands.

Other significant wetlands were surveyed prior to the development of TVARAM; while these areas were not scored using TVARAM, they were assessed using a habitat assessment method that indicated they were of especially high quality. These wetlands are listed in Table 3.7-2.

Table 3.7-2 Watts Bar Parcels with Significant Wetlands

Parcel/Location[1]	Wetland Type[2]	Ecological Significance/Sensitivity[3]	Allocation
103/Hines Creek	PFO	high	Zone 4
268/Muddy Creek	PFO	high	Zone 3
160/Little Emory River	PFO/PSS/PEM	high	Zone 7
183/Swan Pond	PFO	high	Zone 6
185	PFO	high	Zone 4
188	PFO	high	Zone 3
281/Wolf Creek	PFO	Average	Zone 3
169	PFO	Average	Zone 3
166	PFO	Average	Zone 3
233/Whites Creek	PFO	Average	Zone 3

[1] Wetlands occupy portions of these parcels.

[2] P – palustrine; EM – emergent; SS - scrub-shrub; FO – forested; Cowardin 1979; order of wetland class is based on the dominant class in descending order of prevalence.

[3] The rapid assessment methodology used rated the ecological significance/sensitivity of the wetlands as High/Average/Low.

As stated in Section 2, this DEIS includes two Action Alternatives that differ in the land use zone category assigned to certain parcels (Tables 2.1-3 and 2.2-1). A description of each of these parcels is presented below.

Parcels 5, 9, 44, 47, 80,120-123, 12-55, 218, 257, 294-299 Based on National Wetland Inventory (NWI) maps, SMI data, and information from the previous Watts Bar land use plan, these parcels contain no significant areas of wetlands. These parcels, however, may contain some small, scattered scrub/shrub and emergent areas on shoreline portions of some of these parcels.

Parcel 10 NWI maps indicate a small forested wetland occurs in an embayment associated with this parcel.

Parcels 142-148 NWI data as well as SMI data indicates there are extensive areas of wetlands associated with these parcels. A mix of habitat types occurs in this area, and there are areas of forested wetlands along the shoreline of Parcel 144 and 145, as well as emergent and scrub shrub wetlands in the Grassy Creek embayment. There are also forested wetlands within Parcel 146, the Grassy Creek Habitat Protection area.

Parcel 153 SMI data indicates nine small wetlands occur on this parcel. A linear strip of forested wetlands occurs along the shoreline at the northern end of the parcel. The remaining wetlands are a mix of emergent and scrub-shrub wetlands located along the shoreline at the southern end of the parcel.

Parcel 230 SMI data indicates four areas of emergent wetlands occur along the shoreline in coves on this parcel.

3.7.2. Floodplains

The objective of Executive Order 11988 on Floodplain Management is "…to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (WRC 43 FR 6030).

The Order is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. It applies to all Federal Agencies that: acquire, manage, or dispose of Federal lands and facilities; undertake, finance, or assist construction and improvements; and conduct activities and programs affecting land use, including planning, regulating and licensing. Of interest to TVA is that the Order requires that agencies avoid the 100-year floodplain unless it is the only practicable alternative.

The 100-year floodplain on Watts Bar Reservoir is the area that would be inundated by the 100-year flood. There are two main water courses in Watts Bar Reservoir, the Tennessee River and the Clinch River. The 100-year flood elevations for the Tennessee River vary from elevation 746.5-feet msl at Watts Bar Dam (TRM 529.9) to elevation 760.0-feet msl at the upper end of Watts Bar Reservoir at TRM 602.3 (downstream of Fort Loudoun Dam). For the Clinch River, the 100-year flood elevations vary from elevation 747.1-feet msl at the mouth CRM 0.0 to elevation 755.3-feet msl at the upper end of Watts Bar Reservoir at CRM 23.1 (downstream of Melton Hill Dam). Tabulations of the 100-year flood elevations are included in Appendix C, Table C-3.

The Flood Risk Profile (FRP) elevations for the Tennessee River vary from elevation 747.0-feet msl at Watts Bar Dam to elevation 769.3-feet msl at the upper end of Watts Bar Reservoir at TRM 602.3. For the Clinch River, the FRP elevations vary from elevation 748.4-feet msl at the mouth to elevation 759.2-feet msl at the upper end of Watts Bar Reservoir at CRM 23.1. The FRP elevations are based on the 500-year flood and are used to control flood damageable development for TVA projects and on TVA Lands. A tabulation of the FRP elevations are also included in Appendix C, Table C-4.

3.8. Land Use and Prime Farmland

3.8.1. Land Use

Currently, TVA owns and manages 16,000 acres of land and 721 miles of shoreline on Watts Bar Reservoir. The Watts Bar Reservoir flows from the northeast to southwest through Loudon, Meigs, Rhea, and Roane Counties in east Tennessee, which are distinctly rural in description. The principal towns on the reservoir are Spring City, Kingston, Loudon, Rockwood, Lenoir City, Oak Ridge and Harriman. Rural populations are concentrated in the numerous long valleys between the forested ridges. There are several barge terminals and industrial park areas near the larger communities, and some concentrations of residential shoreline developments and marinas. However, most of the Watts Bar Reservoir Shoreline can be typified as appearing forested and rural. Of the 721 miles of shoreline on Watts Bar, 340 miles (47 percent) is available for Shoreline Access, which includes current development. Currently there are over 17,000 acres of platted residential property adjacent to Watts Bar Reservoir public lands, which is 1,000 acres greater than the total amount of TVA public land being planned on the Reservoir. It is estimated that approximately 50 percent of the platted area has already been converted to residential housing with complete conversion of most of these areas anticipated.

When TVA acquired properties around Watts Bar Reservoir, the land uses were primarily small subsistence farming on marginal land with row crop and pasture areas interspersed with woodlands. Following purchase by TVA, much open land was either planted in pine or reverted naturally to pine and/or hardwoods. Now the TVA public land surrounding Watts Bar Reservoir can be broken into five broad community types; forestland, open/agricultural land, shrub/brush land, wetland/riparian/shallow overbank areas, and residential/suburban habitats. Agricultural and grassland habitats are relatively uncommon on Watts Bar Reservoir properties comprising only a few hundred acres. There are 32,476 acres, or 16 percent, of land within a one-mile strip around the Watts Bar Reservoir classified with the agriculture land cover codes. This percentage is much smaller than the percentage of county land in farms. In the last 15 years, except for Meigs County, acreage in county farms has increased by an average of about 8 percent (see section 3.8.2, Prime Farmland). There are currently 13 agricultural licenses for 292 acres of TVA public land on Watts Bar Reservoir (Table 3.8-1), which all 13 licenses expire on December 31, 2008. TVA considers use of TVA public land for agriculture to be a short-term use but provides agriculture licenses under certain circumstances where they are compatible with TVA land management goals or are the best use of the land. Agricultural licenses can be compatible with Zones 2, 3, 4, 5, 6, and 7. An example is utilizing hay crops as an effective way to manage open fields for certain wildlife species, archaeological sites, and reduce maintenance costs for mowing areas of land on recreation and industrial sites. Lands licensed to individual farmers by TVA are largely being farmed to grow hay forage crops for livestock. Even though Parcel 187 is licensed for row crops, it may be used for hay.

Table 3.8-1 Current Agricultural Licenses on Watts Bar Reservoir

TVA Parcel Number	License No.	License Use	Acres Licensed
2	152133	Hay/Row Crop	150
187	152131	Row Crop	3.5
3	152130	Hay	5
177	152124	Hay	15
138*	152120	Hay	13
169	152119	Hay	3.5
42a	152052	Hay	12
241*, 240*	152043	Hay	60
63	151942	Hay	6
85, 86, 87*	152182	Hay	3
152*, 152*, 153	152185	Hay	5
230, 231, 232	152186	Hay	11
152*, 152*, 153	152508	Hay	5

* - Only small portions of this parcel is licensed for agricultural use.

TVA project operations on Watts Bar Reservoir include the Watts Bar Dam Reservation, Kingston Fossil Plant, TVA maintenance facilities, and navigation safety harbors. Although technically downstream of the Watts Bar Dam, Watts Bar Nuclear Plant which is immediately adjacent to the Dam Reservation is included in this Reservoir Land Management Plan. TVA provides the use of public land to public agencies and utilities when in the public interest. Most often these are land use agreements for utility or road right of ways (ROWs), sites for economic development, public works projects (water and sewage), dewatering/pump stations, and community maintenance facilities. The existing land use agreements for Watts Bar Reservoir are summarized in Table 3.8 -2, along with the number of currently approved land use agreements as well as the number that were

approved in 1988. Since 1988 there has been an increase of new 88 agreements for approximately 603 acres of TVA public land.

Table 3.8-2 Number of Land Use Agreements by Category Existing in 1988 and 2004

Land Use Agreement Categories	1988		2004	
	No. of Agreements	Acres	No. of Agreements	Acres
Highways/Roads	49	409	50	430
Railroad Easements	7	9	17	9
Industrial				
Barge Terminals	N/A	N/A	3	11
Industrial Sites	8	1,259	10	1,274
Project Operations				
Maintenance Facility	1	<1	1	<1
Pump Station/Dewatering	5	1	6	1
Recreation	161	3,150	191	3,518
Sufferance Agreements	1	<1	6	<1
Wastewater Treatment	1	1	2	186
Wildlife Management Areas	2	1,900	3	1,900
Utilities				
Electric	8	7	13	8
Gas	2	1	8	3
Sewer	23	8	25	8
Telephone	15	7	20	7
Water	10	22	13	22
Total	**272**	**6,774**	**360**	**7,377**

Currently, TVA has several long-term land use agreements with other Federal, State, and local government agencies for wildlife management areas and refuges and city and county parks. TWRA has long-term land use agreements in Roane County for approximately 1,900 acres of TVA public land for two state refuges and one wildlife management area (WMA) totaling almost 3,900 acres. Kingston Fossil Plant Wildlife Observation Area (Parcel 190), approximately 300 acres, is managed by TVA in cooperation with TWRA. Two small wild areas are located on Watts Bar Reservoir, totaling about 350 acres and are managed for low-impact public use because of their exceptional natural, scenic, or aesthetic qualities. Seven habitat protection areas, approximately 155 acres, have been established to protect populations of endangered or threatened species, unusual or exemplary biological communities, or unique geological features. Seven municipal or county parks totaling approximately 600 acres are located on TVA reservoir lands. In total, about 7,100 acres are managed for natural resource conservation or sensitive resource protection on TVA public land on Watts Bar Reservoir.

Other large tracts of land in the immediate vicinity include the USDOE (U. S. Department of Energy) Oak Ridge Facilities on the upper reaches of Watts Bar Reservoir on the Clinch River. The Oak Ridge State WMA, totaling 37,000 acres is primarily on the ORR and adjacent DOE lands. USDOE manages the Oak Ridge National Laboratory Reservation (ORNL), which is approximately 34,000 acres (excluding the former Clinch River Breeder Reactor site). Of those 34,000 acres, 20,000 acres are defined as the Oak Ridge National Environmental Research Park Biosphere Reserve. These USDOE lands total 71,000 acres adjacent to TVA public lands on Watts Bar Reservoir. Large tracts of privately-owned lands

in the immediate area include Browder Woods, approximately 300 rolling acres of second growth white oak forest and Crowder Cemetery Cedar Barrens, a 258-acre tract containing rare plants (see Managed Areas section 3.4).

There are 22 commercial marinas on Watts Bar; 17 are open and five are closed; two of which have been developed into residential subdivisions. Most marinas adjoin TVA property and are under a license agreement which conveys the land rights for commercial recreation. Some marinas are located on former TVA properties transferred to a city or county for recreation purposes; these marinas operate under a sublease. The remaining marinas reside on former TVA property sold specifically for recreation development. See Recreation, Section 3.11 for more detailed information.

3.8.2. Prime Farmland

Prime farmland has the best combination of soil physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion. This land can be cropland, pastureland, rangeland, forest land, or other land not urban nor water. The conversion of farmland and prime farmland soils to industrial and other nonagricultural uses essentially precludes farming the land in the foreseeable future. Creation of the 1981 Farmland Protection Policy Act addressed this issue and set guidelines which require that all federal agencies evaluate impacts to farmland prior to permanently converting to a non-agriculture land use. The Act requires that Form AD 1006, “Farmland Conversion Impact Rating”, be completed by federal agencies with assistance from the Natural Resource Conservation Service before an action is taken.

The geographic extent of the Watts Bar Reservoir reaches Loudon, Meigs, Rhea, and Roane Counties. Agriculture census data show that in the last 15 years, except for Meigs County, acreage in county farms has increased by an average of about 8 percent (Table 3.8-3). Percent of county land in farms in 2002 is in decreasing order; Loudoun, 54.6, Meigs, 40.0, Rhea, 28.3, and Roane, 26.1 percent. The value of agricultural products sold has increased in all counties, ranging from 8.6 percent in Meigs County to 105 percent for Rhea County. These four counties have a total of 125,964 acres of land with soil properties to be classified as prime farmland ranging from 14.1 percent of Roane County to 21.2 percent of Meigs County (Table 3.8-4).

Table 3.8- 3 Change in Farm Size and Value of Agricultural Products from 1987 to 2002 in Counties adjacent to the Watts Bar Reservoir.

County	1987	1992	1997	2002	Percent Change in 15 Years
Acres in farms					
Loudon	77,665	73,654	73,976	82,656	6.4
Meigs	54,949	56,253	48,977	48,918	-11.0
Rhea	55,956	52,462	56,049	60,762	8.6
Roane	58,739	52,433	53,110	63,378	7.9
Market value of agricultural products sold ($1,000)					
Loudon	31,486	38,546	45,067	50,628	60.8
Meigs	5,195	5,039	4,783	5,642	8.6
Rhea	8,687	7,908	7,575	17,809	105.0
Roane	4,377	4,825	5,771	5,660	29.3

Source: USDA Agriculture Census, http://agcensus.mannlib.cornell.edu/

Table 3.8- 4 Acreage of Farmland in the Counties adjacent to the Watts Bar Reservoir

County	Total Land in County*	Farm Size in 2002**	Farmland in County**	Total Prime Farmland*	Prime Farmland in County*
	Acres	Acres	Percent	Acres	Percent
Loudon	151,323	82,656	54.6	23,459	15.5
Meigs	122,240	48,918	40.0	25,905	21.2
Rhea	214,400	60,762	28.3	42,304	19.7
Roane	243,200	63,378	26.1	34,296	14.1

Source: *Reservoir Operations Study, 2004
**USDA Agriculture Census, http://agcensus.mannlib.cornell.edu/

According to the National Land Cover Database, there are 32,476 acres, 16 percent of land within a one-mile strip around the Watts Bar Reservoir classified with the agriculture land cover codes (Table 3.8-5). This percentage is much smaller than the percentage of county land in farms. Within the area defined by the zone allocations for the Watts Bar planning process, there are 325 acres of land designated as agriculture land in Zone 2, 91 acres in Zone 3, 245 acres in Zone 4, 80 acres in Zone 5, 75 acres in Zone 6, and 210 acres in Zone 7 for a total of 1,026 acres of agricultural land use in the project area (Table 3.8-6)

Table 3.8- 5 Land Cover within 1 mile of Watts Bar Reservoir

Land Cover	Acres within 1 Mile of Reservoir
11 Open Water	14,324
21 Low Intensity Residential	4,023
22 High Intensity Residential	578
23 Commercial, Industrial, or Transportation	2,786
32 Quarries, Strip Mines, or Gravel Pits	132
33 Transitional	535
41 Deciduous Forest	72,990
42 Evergreen Forest	30,793
43 Mixed Forest	40,535
81 Pasture and Hay	24,339
82 Row Crops	5,430
85 Urban/Recreational Grasses	2,707
91 Woody Wetlands	459
92 Emergent Herbaceous Wetlands	146

Source: National Land Cover Database (NLCD), 1992

Table 3.8- 6 Acres of Prime Farmland and Land used for Agriculture in current Watts Bar Land Plan Zones.

Zone	Acres of Prime Farmland *	Acres used for Agriculture**
2	499	325
3	702	91
4	715	245
5	217	80
6	289	75
7	678	210
Totals	**3100**	**1026**

Source: *NRCS-USDA Soil Surveys
** National Land Cover Database

Soils occurring in the Watts Bar Reservoir project area with properties to be classified as prime farmland are generally located on the flood plains of the river and smaller streams. They are formed in local alluvium and are loams, silt loams, or sandy loams. In Loudon County, 83 acres of prime farmland soils occur within the project area and in Meigs County, there are 255 acres. The most prevalent in both counties is Lindside silt loam soil with 30 acres in Loudoun and 73 acres in Meigs County. Rhea county prime farmland soils occupy 804 acres with Etowah loam on 200 acres and Waynesboro loam on 193 acres. Most of the geographic reach of the reservoir is located in Roane County where there are 1,904 acres of soil with prime farmland properties in the project area. The most prevalent is Pope very fine sandy loam soil which occurs on 588 acres. (See Table 3.8-7 for description and acreage of all prime farmland soils in project)

Table 3.8-7 Description of soils with characteristics to be classified as prime farmland in the Watts Bar Land Plan parcels.

County	Soil Symbol	Description	Prime Farmland Acreage
Loudon			
	CmB2	Cumberland silty clay loam, eroded gently sloping	1
	Em	Emory silt loam	13
	HnA	Huntington loam, nearly level phase	19
	HnC	Huntington loam,sloping phase	7
	Ln	Lindside silt loam	30
	Lo	Lindside silt loam, local alluvium phase	1
	SaB	Sequatchie fine sandy loam, gently sloping phase	1
	ScB	Sequatchie loam, gently sloping phase	2
	ScC	Sequatchie loam, sloping phase	5
	Wo	Wolftever silt loam	4
		Total	**83**
Meigs			
	CaB	Capshaw silt loam, 2 to 5 percent slopes	9
	DaB2	Decatur silt loam, 2 to 5 percent slopes, eroded	12
	Eg	Egam silty clay loam	20
	Em	Emory silt loam	2
	EsB	Etowah silt loam, 2 to 5 percent slopes	4

County	Soil Symbol	Description	Prime Farmland Acreage
Meigs			
	EtB	Etowah gravelly silt loam, 2 to 5 percent slopes	2
	HoB	Holston loam, 2 to 5 percent slopes	5
	Ln	Lindside silt loam	73
	Lv	Lobelville cherty silt loam	21
	MrC	Minvale cherty silt loam, 5 to 12 percent slopes	16
	Ne	Newark silt loam	45
	TlB	Tarklin silt loam, 2 to 8 percent slopes	2
	TnC	Tarklin cherty silt loam, 5 to 12 percent slopes	4
	WtB	Whitwell loam, 0 to 5 percent slopes	35
	WvB	Wolftever silt loam, 1 to 5 percent slopes	5
		Total	**255**
Rhea			
	AnB	Altavasta loam, 1 to 5 percent slopes	79
	CaB	Capshaw silt loam, 2 to 5 percent slopes	63
	Eg	Egam silty clay loam, 0 to 3 percent slopes	4
	EtB	Etowah loam, 2 to 5 percent slopes	200
	Ha	Hamblen silt loam, occasionally flooded	73
	HoB	Holston loam, 2 to 5 percent slopes	45
	ShB	Shady loam, 1 to 5 percent slopes	6
	Sm	Shady loam, 0 to 3 percent slopes, occasionally flooded	19
	TmB	Tasso-Minvale complex, 2 to 5 percent slopes	102
	WbB2	Waynesboro loam, 2 to 5 percent slopes, eroded	193
	WfB	Wolftever silt loam, 2 to 5 percent slopes	20
		Total	**804**
Roane			
	Af	Allen very fine sandy loam	5
	Av	Apison very fine sandy loam	17
	Gs	Greendale silt loam	58
	Hl	Huntington silt loam (Arrington)	115
	Jg	Jefferson gravelly fine sandy loam	7
	Ll	Lindside silt loam	66
	Lv	Leadvale very fine sandy loam	85
	Nv	Nolichucky	78
	Pg	Pope gravelly fine sandy loam	70
	Pl	Pope loamy fine sand	169
	Ps	Philo very fine sandy loam (Sil)	63
	Pv	Pope very fine sandy loam	588
	Rg	Roane gravelly loam	91
	Sv	Sequatchie very fine sandy loam	217
	Ws	Wolftever silt loam	223
	Wv	Waynesboro very fine sandy loam	52
		Total	**1904**

Sources: Soil Surveys of Loudoun, Meigs, Rhea Counties, and Roane Counties, USDA-NRCS

Prime farmland soils occurring in the parcels designated as Zone 2 total 499 acres (Table 3.8-6). Zones 3 and 4 will protect prime farmland and there are 702 and 715 acres, respectively in those zone allocations. Land allocated to Zones 5, 6, and 7 will potentially have soil disturbance activities and impacts to prime farmland soils. There are 217 acres allocated to Zone 5, 289 acres to Zone 6, and 678 acres to Zone 7. Prime farmland soils occur in 233 parcels. Tables 3.8-8 to 3.8-13 contain the farmland statistics by zone and parcel.

Table 3.8- 8 Acreage of Prime Farmland (greater than 1 acre) and Agricultural Land use for each Parcel allocated to Zone 2.

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
3	280	137	49	193	95
4	146	10	7	16	1
274	2	2	97		
282	246	51	21	43	13
294	34	19	57		
122	9	3	37	2	
158	26	11	43		
190	300	4	43		
207	19	3	14	4	
213	4	2	43		
88	642	256	39	50	26

Table 3.8-9 Acreage of Prime Farmland (greater than 1 acre) and Agricultural Land use for each Parcel allocated to Zone 3.

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
101	22	12	58		
103	15	2	13		
93	10	5	51	2	1
97	39	25	63		
8	141	8	6	1	
233	81	30	37	7	4
237	87	22	25		
238	171	15	9	2	
253	19	14	73	1	1
254	427	23	5	11	9
268	39	39	98	13	13
276	49	22	45	6	3
281	8	8	96		
288	9	7	83		
132	5	4	83		

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
138	5	3	63		
139	19	9	48		
141	63	60	94	11	11
144	48	38	79		
146	99	8	8		
149	13	5	39		
159	3	3	87		
166	79	57	72	5	2
169	12	10	82		
171	5	5	100		
173	10	10	97	1	1
176	3	3	100		
180	11	7	57	6	4
188	25	11	44	11	2
193	8	7	89		
194	8	2	19		
196	11	8	69		
214	14	10	68		
233	81	24	30	7	4
46	785	17	2	5	
50	20	20	100	2	2
69	4	4	100		
71	15	8	55		
75	15	15	95		
78	83	83	100		
97	39	39	100		

Table 3.8-10 Acreage of Prime Farmland (greater than 1 acre) and Agricultural Land use for each Parcel allocated to Zone 4.

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
100	11	9	81	2	2
104	7	2	23		
92	34	9	27	5	1
31	7	2	35		
7	728	9	1	3	
175	4	4	100	2	1
263	14	4	25		
267	26	25	95	5	4
278	20	18	91	3	3
280	71	11	15	6	

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
283	132	4	3	13	
285	225	73	33		
286	43	5	12	1	
290	10	2	20	1	
291	97	17	17		
292	24	2	9		
296	200	46	23	35	17
306	55	5	10	2	
107	20	18	90		
129	24	4	18		
130	60	20	32	1	
134	62	35	56	7	5
137	79	50	63	10	8
155	10	8	81		
156	16	2	15		
161	18	12	66	2	2
162	15	12	80		
165	48	21	45	21	11
168	46	43	94	16	15
172	21	11	54	2	
179	56	26	47	7	5
182	37	20	54	4	4
187	57	27	47	14	5
189	22	15	69		
192	6	3	45		
200	25	10	39	3	
202	29	7	24	4	
204	24	10	43	2	2
217	31	7	22		
306	55	3	6	2	
40	175	1	1		
44	23	2	9		
51	42	8	18	23	5
54	22	20	92	1	1
60	1	1	89		
62	5	5	96		
64	1	1	92		
67	4	3	65		
72	112	17	15	36	10
73	27	3	11	3	
80	15	6	42		
82	37	7	20		
89	31	23	74	8	7

Table 3.8-11 Acreage of Prime Farmland (greater than 1 acre) and Agricultural Land use for each Parcel allocated to Zone 5.

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
140	8	8	100	3	3
142	320	25	8	5	
143	391	2	1	4	
145	333	107	32	56	7
147	12	5	39		
148	21	2	12		
170	6	6	100		
174	22	20	93		
181	8	1	14		
191	4	1	39		
218	61	4	7	5	
297	245	34	14	7	

Table 3.8-12 Acreage of Prime Farmland (greater than 1 acre) and Agricultural Land use for each Parcel allocated to Zone 6.

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
1	11	11	100		
10	78	9	12	2	
116	7	3	38	4	1
121	26	9	37	6	3
12-18	2	2	99		
12-29	5	2	34		
12-30	5	3	50	2	2
12-32	3	1	42		
12-35	3	2	61		
12-36	4	3	71		
12-44	3	2	85		
12-48	10	2	21		
12-50	8	1	14		
12-53	6	3	47		
12-54	2	1	72		
12-60	2	1	50		
12-66	4	2	64		
12-68	6	2	38		
12-70	5	1	23		
12-8	3	3	94		
13-39	7	3	38		
183	25	15	61		
201	84	25	30	1	
219	69	19	28	14	4

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
230	24	4	16	2	
240	7	6	84		
255	9	6	68		
264	5	4	85		
266	94	19	20		
270	53	8	16	5	2
277	11	7	64	1	1
299	370	18	5	2	
300	240	3	1	4	
45	33	7	21	3	2
5	249	22	9	9	1
68	24	20	82	14	12
74	78	2	3		
9	122	13	11		
98	9	4	44	3	1
99	10	6	61	4	4

Table 3.8-13 Acreage of Prime Farmland (greater than 1 acre) and Agricultural Land use for each Parcel allocated to Zone 7.

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
102	53	2	3	12	7
90	5	1	20	2	
95	20	3	15	6	1
11	41	6	14	2	
15	76	8	11	2	
16	28	1	5	2	
25	91	13	14	10	4
234	40	31	78	3	2
239	24	1	1		
242	17	11	67		
248	45	4	9		
251	24	3	13	2	
252	12	3	25		
259	12	4	34		
260	53	7	14		
262	41	34	82	5	5
265	51	43	83	10	10
269	37	24	65		
273	11	7	66	2	2
287	27	4	14		
289	38	19	50	2	1
293	24	10	42	11	4

Parcel Number	Total Acres	Prime Farmland Acreage	Percent Prime Farmland in Parcel	Acres of Parcel used for Agriculture	Acres of Prime Farmland in Parcel used for Agriculture
102	53	25	47	12	7
109	10	7	75	2	2
112	26	10	39	1	
113	6	2	41		
117	28	13	46	2	
118	25	8	33	3	
119	8	1	13		
123	20	2	10		
127	20	10	50	4	2
128	19	16	85		
133	16	5	29	4	
150	7	5	62		
151	17	9	55		
153	46	18	38	2	
154	28	23	82		
157	26	8	32		
160	15	11	74		
167	12	12	96		
184	29	4	14	4	2
195	15	2	13		
197	24	4	16	5	
199	39	5	13	2	
203	17	8	45		
206	17	7	41	2	
210	12	2	24		
212	76	26	34	24	11
216	31	6	18		
220	18	2	9		
221	75	8	10	5	2
229	42	5	12	1	
232	39	5	13	2	
34	25	1	6		
36	54	19	35	6	2
38	35	4	10	5	
43	47	4	8	4	
48	66	22	33	3	
53	45	28	61	10	8
56	62	10	16	4	
59	35	13	36		
61	31	8	27	3	
63	46	23	52	21	14
66	29	16	55	6	4
81	24	10	42		
90	17	2	12	2	

Historically, TVA understands the value of farmland and has continued to license portions of its public lands for use as agriculture. There are 30 parcels with existing licenses. These are listed in Table 3.8-14. Four of these parcels are allocated for project operations, 2, 3, 207, and 282. Parcel 3 has the largest amount of land currently licensed with 159 acres. There are 90.2 acres licensed in Parcel 296, one of the parcels proposed for allocation change to mixed-use development. Parcel 218, which is allocated to Zone 5 for potential development, has 26.6 licensed acres. Acreage allocated to Zones 2, 3, and 4 could continue to be licensed.

Table 3.8-14 Parcels with Existing Licenses for Use as Agriculture.

Zone	Parcel	Total Acres	Acres Licensed
2	2	23.8	0.1
2	3	280.4	159.0
2	207	19.1	4.8
2	282	169	22.6
3	103	14.9	2.1
3	159	3.4	0.7
3	169	12.4	4.1
3	173	9.8	2.7
3	233	80.6	16.0
4	51	42.2	23.3
4	72	111.9	19.3
4	130	60.3	8.8
4	161	18.1	3.9
4	168	45.7	10.5
4	187	56.8	10.3
4	224	128.6	4.5
4	228	22.4	1.4
4	271	14.0	5.9
4	280	70.6	0.0
4	283	132.1	25.7
4	296	199.8	90.2
5	218	61.4	26.6
6	219	69.4	0.2
7	52	12.4	1.0
7	63	45.5	11.3
7	102	53.3	1.8
7	160	14.8	2.8
7	162	14.7	7.9
7	167	12.3	0.6
7	229	42.1	0.7

Thirty-two parcels are proposed for change in zone allocation resulting from this land use planning process. Table 3.8-15 shows the acres of prime farmland and acres of land used for agriculture in these parcels with more than 1 acre of prime farmland. There are 107 acres of prime farmland in parcel 145 and 34 acres in parcel 297 which are allocated to Zone 5 for the No Action Alternative and for Alternative B. Parcel 145 has 56 acres classified as agricultural land cover. Parcel 296 with 46 acres is allocated to Zone 5 for Alternative B and has 35 acres of land used for agriculture. For these parcels that are greater than 10 acres, completion of Form AD 1006 will be required before any soil disturbance activities are initiated.

Table 3.8-15 Acres of Prime Farmland and Land used for Agriculture in Parcels proposed for Allocation Change.

Parcel Number	Total Acres	Acres of Prime Farmland	Percent Prime Farmland	Acres of Parcel used for Agriculture	Acres of Prime Farmland used for Agriculture
5	249	22	9	9	1
9	122	13	11		
10	78	9	12	2	
44	23	2	9		
80	15	6	42		
119	8	1	13		
121	26	9	34	6	3
122	9	3	37	2	
123	20	2	10		
142	320	25	8	5	
143	391	2	1	4	
144	48	38	79		
145	333	107	32	56	7
146	99	8	8		
147	12	5	39		
148	21	2	12		
153	46	18	38	2	
218	61	4	7	5	
240	7	6	84		
294	34	19	57		
296	200	46	23	35	17
297	245	34	14	7	
299	370	18	5	2	

3.9. Cultural Resources

For at least 12,000 years, the Tennessee River and the Little Tennessee River Valley have been an area for human occupation which became more intense through succeeding cultural periods. In the upper east Tennessee area, archaeological investigations have demonstrated that Tennessee and the eastern Ridge and Valley Region were the setting for each one of these cultural/temporal traditions, from the Paleo-Indian (12,000-8,000 B.C.), the Archaic (8,000-1,200 B.C.), the Woodland (1,200 B.C.-1,000 A.D.), the Mississippian

(1,000-1,500 A.D.), to the Protohistoric-Contact Period (1,500-1,750 A.D.). Prehistoric archaeological stages are based on changing settlement patterns. Smaller time periods, known as “Phases” are represented by distinctive sets of artifact remains. In addition, historic era cultural tradition have included the Cherokee (1,700 A.D.-present), European and African-American (1,750 A.D.-present) occupations.

The Paleo-Indian Period (12,000-8,000 B.C.) represents the documented first human occupation of the area. The settlement and land use pattern of this period were dominated by highly mobile bands of hunters and gatherers. The subsequent Archaic Period (8,000-1,200 B.C.) represents a continuation of the hunter-gatherer lifestyle. Through time, there is increasing social complexity and the appearance of horticulture late in the period. The settlement pattern during this period is characterized by spring and summer campsites. Increased social complexity, reliance on horticulture and agriculture, and the introduction of ceramic technology characterize the Woodland Period (1,200 B.C.-1,000 A.D.). The increased importance of horticulture is associated with a less mobile lifestyle as suggested by semi-permanent structures. The Mississippian Period (1,000 -1,500 A.D.), the last prehistoric period in east Tennessee, is associated with the pinnacle of social complexity in the southeastern United States. This period is characterized by permanent settlements, maize agriculture and chiefdom level societies.

The Archaic through Mississippian Periods have been intensively investigated in East Tennessee (Chapman 1973, 1975, 1977, 1978, 1979a, 1979b, 1981; Cridlebaugh, 1981; Kimball, 1985; Polhemus, 1987; Davis, 1990; Guthe and Bistline, 1981). In addition, it is widely known historically that many settlements along the Little Tennessee River were Overhill Cherokee villages (Timberlake, 1927; Bartram, 1995). Many archaeological investigations in the 1960s and 1970s focused on the Cherokee occupation of the area (Schroedl, 1985; Baden, 1983; Russ and Chapman, 1984). All of these investigations have provided additional details about the changing environments, shifting subsistence strategies and settlement patterns, and variations in the cultural material associated with each major stage.

Watts Bar Reservoir is located in four Tennessee counties (Roane, Rhea, Meigs and Loudon). In 1792 John Sevier established Fort Southwest Point at the convergence of the Tennessee and Clinch rivers to protect white settlers traveling west. Roane County was established in 1801 at the juncture of the Tennessee, Clinch, and Emory rivers. The town of Kingston was chosen as the county seat in 1807 (Hall 1998). Rhea County was established in 1807, from a portion of Roane County. The new county was situated in a valley between the Tennessee River and Cumberland Plateau. Though enlarged in 1817, parts of the county were lost in the formation of Hamilton County in 1817 and Meigs County in 1836 (Broyles 1998). Meigs County was established in 1836 from Rhea County. The county is bounded on the west by the Tennessee River and the lower Hiwassee River crosses through the southern portion of the county. The county contains fertile bottom land and ample timber, as well a vein of iron core (Toplovich 1998). When Tennessee voted on secession in June 1861, the majority of these counties sided with the Confederacy. No major Civil War battles were fought in these counties, but there were massive troop movements through the area. Industrialization developed slowly after the Civil War. Loudon County was established on June 2, 1870, from portions of Roane, Monroe, and Blount counties. Loudon County lies on both sides of the Tennessee River and extends north to the Clinch River. The Little Tennessee River also passes through the county. Settlements were made on the north banks of the Tennessee and the Little Tennessee before 1800 (Spence 1998). TVA brought changes to the area with the construction of a

reservoir network along the Tennessee and Little Tennessee River Valley (Chickamauga in 1940, Watts Bar in 1942, and Fort Loudon 1943, and Tellico 1979). TVA's construction of Sequoyah and Watts Bar plants south and north of the county in the 1970s added residential growth.

The National Historic Preservation Act (NHPA) of 1966 and the Archaeological Resources Protection Act (ARPA) of 1979 address the protection of significant archaeological resources and historic properties located on TVA lands or affected by TVA undertakings. A historic property is defined under 36 CFR Part 800.16 (1) as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places." (NRHP).

In response to this federal legislation, TVA conducts inventories of its lands to identify historic properties. For the action proposed, the Area of Potential Effect (APE) is approximately 16,000 acres of land that TVA retained or previously committed to specific land uses. The Area of Potential Effect (APE) as defined in 36 CFR Part 800.16 (d) is "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist."

In September 2004 TVA consulted with the Tennessee State Historic Preservation Officer and appropriate affiliated Native American Indian Tribes for this project. The comments are attached in Appendix C.

3.9.1. Archaeological Resources

The Watts Bar Reservoir area has been the focus of archaeological research since the early 19th century. The earliest description of prehistoric Native American culture within the Watts Bar study area comes from John Haywood (1823, 1959) who described the mounds of the Bell and DeArmond sites as they were seen in the early 1800s. It was not until the 1930s and 1940s during the extensive Works Progress Authority (WPA) projects in preparation of the Chickamauga and Watts Bar reservoirs that extensive survey and excavations were undertaken (Ahlman 2000). Three major archaeological surveys and numerous small scale surveys were done for the Watts Bar Reservoir. In the early 1940s, prior to TVA's inundation of Watts Bar Reservoir, archaeological investigations (including site recording and in some cases excavation) were conducted in the flood zone. To address land management concerns for the 1988 Plan, TVA contracted with the University of Tennessee (UT) to conduct an archaeological survey, in 1986. Later in the 1990s, UT surveyed an additional 6,861 acres of TVA fee-owned lands and 6 miles of shoreline on the Watts Bar Reservoir. The last large scale survey was conducted by means of a pedestrian survey and systematic shovel testing from existing humus to culturally sterile subsoil. The soil matrix was screened through a one-fourth inch wire mesh screen. Crew members walked the areas in 20-meter transects and excavated shovel test pits on 20-meter centers along each transect in zones of low slope and/or high site probability.

Existing data was reviewed, during this assessment and over 700 archaeological resources have been identified within and along the Watts Bar Reservoir. Prehistoric components and sites dating from the Paleo-Indian through Mississippian Periods were recorded. Historic archaeological sites were associated with the nineteenth- to twentieth-century habitation of the area.

3.9.2. Historic Structures

A major historic structures survey was done for the 1988 Watts Bar Lands Plan. This was conducted by TVA Cultural Resources staff and included sites on TVA lands and on adjacent non-TVA lands within the APE. This survey identified 17 structures listed on the NRHP and 25 eligible for listing; 150 historic structures and/or historic districts of which many are probably eligible for listing, and 171 which are no longer eligible for listing.

Initially White settlement in the early 19th century developed into an agricultural economy with farmsteads and small towns. Transportation networks revolved along the Tennessee River. Towns grew and prospered and a plantation economy developed. Towns became river ports and many ferry crossings were established. The later development of the railroad resulted in rail lines following the river valley. The Civil War brought destruction and economic devastation to the area. Following this war, development was slow. Agriculture, commerce, industry, and the river and rail systems gradually expanded.

The coming of TVA and the development of Watts Bar Reservoir (1939-1942) resulted in further significant changes of the region. The acquisition of land for the Watts Bar Reservoir by TVA resulted in the removal of most structures and other man-made features on these TVA lands. Very few structures remained, though many historic structures do remain on adjacent non-TVA lands. Historic structures (and other man-made features) remain from all these historical periods. The earliest settlements tended to be on the waterways and many of these were lost to TVA's reservoir development. Also the richest farmlands and the most prosperous farms and plantations were located on the river bottoms. Many of these were also lost.

Only a small portion of these identified historic structures have the potential to be affected by the allocations of the 32 parcels. The only eligible historic structures on TVA lands are the Watts Bar Steam Plant; the Watts Bar Dam, Locks and Power House; and a number of remaining dwellings from the original construction village (now Watts Bar Resort).

3.10. Navigation

Watts Bar Reservoir is one of nine impoundments that make the commercially navigable, Tennessee River System possible. This approximately 650-mile system connects Knoxville, Tennessee at the upper end with Paducah, Kentucky at the confluence of the Tennessee and the Ohio rivers, and provides for year-round navigation the length of the Tennessee River, with an additional 150 miles of navigable tributaries. The Tennessee River system is in turn part of the interconnected National Inland Waterway System that links much of the eastern half of the United States by water transportation, with coastal and Great Lakes links to the rest of the world.

Watts Bar reservoir is bounded by three dams with navigation locks. Watts Bar Lock and Dam, at TRM 529.9, marks the southern (downstream) boundary of the reservoir and Fort Loudoun Lock and Dam defines the upstream limits of the reservoir at TRM 602.3. In addition, Watts Bar reservoir extends into two navigable tributaries of the Tennessee River; the Emory River, navigable for twelve miles to the town of Harriman, and the Clinch River. While the Clinch is navigable for 62 miles to the town of Clinton, Melton Hill Lock and Dam at mile 23.1 marks the furthest extent of Watts Bar reservoir on the Clinch River.

In 2003, the most recent year for which there is comprehensive data, over 1.4 million tons of commercial cargo moved on Watts Bar reservoir (USACE, 2003a). About 800 thousand tons of this traffic either originated or terminated at the five active commercial barge terminals located on Watts Bar reservoir. The average tow size on Watts Bar reservoir in 2003 was 6.5 barges with a total of over 900 barge tows (USACE, 2003b). Commodities transported include grains and grain products, iron and steel, minerals, asphalt, sand, salt, and fertilizers.

The economic impact of commercial waterway transportation is typically measured in terms of the transportation savings (or shipper savings) that accrues to the area's economy. Shipper savings from commercial waterway traffic originating or terminating on Watts Bar reservoir in 2003 was 7.4 million dollars. The average shipper savings benefit to the area for the period 1997 to 2003 was just under 10 million dollars annually.

To support commercial waterway traffic, TVA and the U.S. Coast Guard maintain a number of navigation aids either on the water or along the shoreline. These include main channel and secondary channel buoys; mooring cells, dolphins, and buoys; dayboards (navigation signs) and lighted beacons; and shoreline signs for safety harbors and landings and secondary channels. (A safety harbor is a cove or embayment off the main channel into which a tow may pull in high flow or inclement weather conditions; a safety landing marks a place on the shoreline of the main channel where a tow may tie off in poor conditions.)

Navigation aids also support recreational boat traffic, as do the locks at Watts Bar and Fort Loudoun Dams (Melton Hill Lock was closed to all but essential traffic in August of 2003 due to an electrical system failure in the mechanism that fills and empties the lock chamber). While it is impossible to know the actual number of recreational vessels on Watts Bar reservoir at any one time, several indicators may provide useful information. For example, in 2003, 1,240 recreational vessels locked through at Watts Bar Lock and 1,991 recreational vessels locked through at Ft. Loudoun Lock (USACE, 2003b).

TVA's comprehensive Reservoir Operations Study (ROS) Final Environmental Impact Statement (FEIS) recreation field study (TVA, 2004), indicates that in 2002, there were about 1.9 million visitor days to Watts Bar Reservoir. 874 thousand visitor days (46 Percent) were attributed to use of commercial facilities for access of Watts Bar Reservoir, 702 thousand (37 Percent) accessed from private residences, and 313 thousand (17 Percent) from public facilities. A subsequent internal TVA inventory of recreation facilities shows that, in 2004, there were 50 paved boat ramps on Watts Bar reservoir, and about 1,500 boat docking slips at area marinas, with an additional 238 out of water storage slips. The inventory also shows that there were 16 facilities on Watts Bar Reservoir where one could rent boats or personal watercraft in 2002 (TVA, 2005).

A query of TVA's reservoir access permit (Section 26a) database reveals that, as of the end of 2004, there were 3,591 permitted docks on the reservoir. Finally, Tennessee boater registration data for 2003 (TWRA, 2003) shows that there were 48,848 boats and personal watercraft registered with an address within 25 miles of Watts Bar Reservoir.

3.11. Recreation

Watts Bar Reservoir receives an estimated1.9 million recreation user days per year according to the recent TVA River Operations Study (ROS) EIS (TVA, 2004). Watts Bar ranks behind Norris, Kentucky, and Guntersville Reservoirs in total water-based recreation

activities. From a recreational standpoint, Watts Bar Reservoir is a reservoir in transition. It still has remnants of the 1960s and 1970s fish camps and small, quaint marinas. However, this situation is changing. Several marinas and campgrounds are in the process of upgrading their facilities to meet the demands for mooring larger boats and accommodating larger recreational vehicles popular with today's recreating public.

In 1988, TVA provided direct recreation opportunities in the form of campgrounds, day-use areas, and boat ramps on Parcels 4, 10, 22, 74, and 266. However, TVA has currently leased three of the five parcels, closed one, and in the process of leasing the fifth. Although TVA provides the water base, very few direct recreation opportunities on Watts Bar are supplied by TVA. However, the dam reservation is available for use, and TVA provides access to undeveloped lands.

Of the total 1.9 million visitor days, approximately 313,000 occurred through public access, 702,000 occurred through private access, and 874,000 occurred through commercial access. According to the developed recreation inventory completed by TVA in 2004, there are 29 commercial recreation establishments, 36 public areas, three church camps and a Boy Scout camp on Watts Bar Reservoir. The recreational facilities provided are shown below in Table 3.11-1. As shown in the table, the majority of recreation facilities on Watts Bar Reservoir are supplied by the commercial sector. A listing of developed recreational opportunities on Watts Bar Reservoir is provided as Table 3.11-2.

A limited amount of additional lands have been requested for developed recreation in this planning process. Proposed additional developed recreation would involve Parcels 9, 44, 80, 120, 257, and 279, which total 193.5 acre.

In the past, TVA accommodated the recreation use occurring on undeveloped reservoir lands by directly supplying developed recreation opportunities. Although this role has decreased, recreation use of the undeveloped public lands around Watts Bar has continued. The amount of undeveloped or informal recreation use that occurs on Watts Bar TVA lands is unknown, but it is assumed to be a much smaller number than the 1.88 million figure for water-based recreation. The recreation activities engaged in on undeveloped lands are very similar to those recreation activities engaged in a developed area. With the exception of hunting, other recreation activities, i.e., bank fishing, boat fishing, swimming, camping, and personal watercraft use, are common at both developed and undeveloped areas. Finally, the types of recreation opportunities that can be provided on the public lands and waters of Watts Bar Reservoir, i.e., day hiking, wildlife viewing, developed camping, picnicking, swimming, biking, and boating, continue to be high-growth recreation activities and/or those activities with high participation rates (Cordell, 2004).

The ROS EIS focused on water-based recreation and did not account for people using land-based recreation such as trails, visitor overlooks, driving for pleasure, hunting, etc. The undeveloped lands around Watts Bar support many of these types of activities. Although these types of uses are not quantified, these uses are extensive based on the visual impacts of foot paths, bare soils, litter and other indicators. Some of the important places on Watts Bar Reservoir that support dispersed, informal wildland recreation, are Parcels 7, 46, 88, 254, 227, and 283. Considerable logging has occurred on Parcels 297 and 299 as a result of damage from the southern pine bark beetles. However, the size of these two parcels (245 and 370 acres, respectively) makes them important wildland recreation parcels.

Table 3.11-1 Recreation Facilities on Watts Bar Reservoir

Facility Type	Commercial	Public
Wet Slips	1,447	0
Dry Slips	238	0
Campsites with electrical hookups	650	0
Campsites without electricity	122[1]	0
Paved boat ramps	20	28
Parking spaces	1,080	616
Picnic tables	92	298
Picnic pavilions	5	20

[1] *TVA is in the process of making 44 unused campsites in this total available by soliciting bids for Rhea Springs (Parcel 266).*

Table 3.11-2 Developed Recreational Facilities on Watts Bar Reservoir.

Area Name	Operator	River Mile[1]	Parcel(s)	Acreage[2]
Soaring Eagle	Commercial	C 17.0 L	136	11.8
Watts Bar Marina & Resort	Commercial	T 530.0 R	300	237.6
Piney Point Resort	Commercial	T 532.5 R	264	5.2
Rhea Harbor	Commercial	T 532.5 R	275	2
Spring City Boat Dock	Commercial	T 532.5 R	277	11.5
Fooshee Pass	Commercial	T 538.0 L	10	78.4
Sam's Dock	Commercial	T 538.2 L	14	1.7
Cherokee Point Campground	Commercial	T 538.5 L	13	6
Euchee Marina & Campground	Commercial	T 539.9 L	18 and 20	10.2
Hornsby Hollow	Commercial	T 540.0 L	22	58.1
Campground on the Lakeshore	Commercial	T 541.0 L	27	1.8
The Landing	Commercial	T 541.5 L	29	2.3
Red Cloud Campground	Commercial	T 542.0 R	Non-TVA Property	-
Eden Resort Marina	Commercial	T 542.3 R	250	0.9
Arrowhead Resort	Commercial	T 545.0 R	241	1.2
Brigadoon Resort	Commercial	T 545.0 R	230	24.2
Lakeshore Resort	Commercial	T 545.0 R	235	2.5
Shelton's Campground	Commercial	T 545.0 R	Non-TVA Property	-
Terrace View Resort	Commercial	T 545.0 R	245	1.3
Blue Springs Boat Dock	Commercial	T 547.2 L	37	2.9
Bayside Marina	Commercial	T 548.0 L	41 and 42	4.7
Harbor Point Marina	Commercial	T 551.8 R	222	4.6
Caney Creek Campground	Commercial	T 562.3 R	201	34.4
Caney Creek Marina	Commercial	T 562.3 R	201	-[3]
Watts Bar Lake Campground & Marina	Commercial	T 562.5 L	Non-TVA Property	-
Southwest Point Golf Course	Commercial	T 567.0 L	68	18.2
Riley Creek Rec. Area	Commercial	T 570.0	74	77.7
Long Island Marina	Commercial	T 571.7	114	3.9
Southwest Point	City of Kingston	C 0.0 L	68	
58 Landing Park	City of Kingston	C 0.5 L	121	28.5
Kingston City Park	City of Kingston	C 1.0 L	121	

Area Name	Operator	River Mile[1]	Parcel(s)	Acreage[2]
Kingston	TWRA	C 2.4 L	12-44	2.7
Ladd Park	City of Kingston	C 4.5 L	125	1.9
Little Emory	TWRA	E 0.5 R	12-48	8.4
Sugar Tree	TWRA	E 0.8 L	12-53	6.2
Harriman City Ramp	City of Harriman	E 10.5 R	175	3.4
Harriman Riverfront Park	City of Harriman	E 12.5 R	Non-TVA Property	
Watts Bar Dam Reservation--Headwater	TVA	T 530.0	4	145.5
Meigs County Park	Meigs County	T 531.0	5	248.9
Rhea Springs	TWRA	T 532.2 R	12-8	3.4
Rhea Springs	Rhea County	T 532.5 R	266	94.4
Veteran's Park	Spring City, TN	T 532.5 R	270	26.7
Lake View	TWRA	T 539.0 L	12-4	4.5
Big Springs	TWRA	T 540.5 L	12-6	4.3
Roddy	TWRA	T 544.7 R	12-26	1.5
Rector Branch	TWRA	T 545.0 R	12-17	2.3
Hogback	TWRA	T 546.0 R	12-24	3.3
Blue Springs	TWRA	T 547.5 L	12-20	5.1
Ferguson Branch	TWRA	T 551.3 R	12-29	4.9
Rockwood Community Park	City of Rockwood	T 553.0 R	219	69.4
New Hope	TWRA	T 553.8 R	219	2.9
Shady Grove	TWRA	T 557.1 L	12-32	3.9
Brown's Chapel	TWRA	T 561.1 R	12-36	49.8
Roane County Park	Roane County	T 562.3 R	201	49.8
KOA	TWRA	T 562.5 L	12-38	2.2
Belcove	TWRA	T 569.4 R	12-43	0.8
Mourneys Cove	TWRA	T 569.7 L	12-41	2
Laurel Bluff	TWRA	T 572.5 L	12-59	3.8
Johnson Creek	TWRA	T 572.5 R	12-62	1.6
Pond Creek	TWRA	T 579.6 L	12-68	4.8
Riverside Park	City of Loudon	T 591.7 L	99	9.1
John Knox Presbytery Camp	Church Camp	T 550.0 L	45	32.5
Camp Buck Toms	Boy Scouts of America	T 551.0 R		
Cedine Bible Camp	Church Camp	T 544.3 R	Non-TVA land	-
Rockwood First Baptist Church Camp	Church Camp	T 545.0 R	Non-TVA land	-

[1] *River Mile is distance from the mouth of the river; C = Clinch River, E = Emory River, T = Tennessee River; L = left bank (facing downstream), R = right bank (facing downstream).*

[2] *Acreage not provided when no TVA property was involved.*

[3] *Caney Creek Campground and Caney Creek Marina comprise a total of 34.4 acres.*

3.12. Visual Resources

Watts Bar Reservoir extends from dam at the head of the Chickamauga pool to Ft. Loudoun Dam near Lenoir City, TN and lies in a region of the Tennessee River Valley noted for a wide variety of scenic resources. Watts Bar provides 722 miles of shoreline and over 39,000 acres of water surface. The reservoir and floodplain areas include attractive islands, rock bluffs, secluded coves, wetlands and agricultural land which are framed by high wooded ridges. Since the scenic features of the ridge and valley landscape are not limited by property boundaries, the attractive landscape character extends across TVA public and private land alike. The natural elements together with the communities and other cultural development provide a scenic, relatively harmonious, rural countryside.

Land uses adjacent to the Watts Bar Reservoir shoreline are similar to other mainstream reservoirs. They include industrial areas and two TVA facilities (Watts Bar Nuclear Plant and Watts Bar Hydro Plant) as well as state and local parks, WMAs, commercial recreation facilities, and an ever-growing assortment of residential development. The reservoir offers abundant water-recreation opportunities along with a variety of scenery. Most creek embayments are broadly open at the mouth and some wind several miles to their headwaters.

The physical, biological, and cultural features seen in the landscape give reservoir land its distinct visual character and sense of place. Varied combinations of these elements make the scenic resources of any portion identifiable and unique. Areas with the greatest scenic value such as islands, bluffs, wetlands, or steep forested ridges generally have the least capacity to absorb visual change without substantial devaluation. In the planning process, comparative scenic values of reservoir land were assessed to help identify areas for scenic conservation and scenic protection. Four broad visual characteristics were evaluated. Two of these distinct but interrelated characteristics—viewing distance and human sensitivity—are commonly considered together as scenic visibility:

Scenic attractiveness is the measure of outstanding or unique natural features, scenic variety, seasonal change, and strategic location.

Scenic integrity is the measure of human modification and disturbance of the natural landscape.

Viewing distance indicates scenic importance based on how far an area can be seen by observers and the degree of visible detail.

The foreground distance is within one-half mile of the observer where details of objects are easily distinguished. Details are most significant in the immediate foreground from 0 to 300 feet.

Middleground is normally between a half mile and four miles from the observer where objects may be distinguishable, but their details are weak and tend to merge into larger patterns.

Background is the landscape seen beyond four miles where object details and colors are not normally discernible unless they are especially large, standing alone, or provide strong contrast. Figure 3-1 illustrates the viewing distance parameters.

Human sensitivity is the expressed concern of people for the scenic value of the land under study. Concerns are derived or confirmed by public meetings and surveys. Sensitivity also includes considerations such as the number of viewers, frequency, and duration of views.

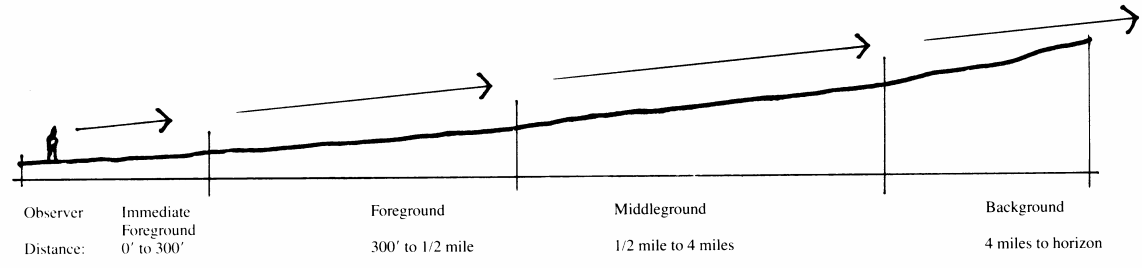


Figure 3.12-1 Viewing Distance

Where and how the reservoir landscape is viewed affects human perceptions of its aesthetic quality and sense of place. These impressions of the visual character can significantly influence how the scenic resources of public lands are appreciated, protected, and used.

3.12.1. Environmental Setting of Watts Bar Lake

Among the scenic resources of Watts Bar Reservoir, the water body itself is the most distinct and outstanding aesthetic feature. The horizontal surface provides visual balance and contrast to the islands, bluffs, and wooded hillsides. The reservoir provides harmony and creates mystery as it weaves around the ridges and bends, constantly changing views seen from the water. It also provides unity, serving as a visual ribbon that links the other landscape features together. Views across the water provide a tranquil sense of place that is satisfying and peaceful to most observers.

Islands are another significant visual feature. Numerous notable islands have been identified, and a number of minor ones. The islands provide scenic accents and visual reference points throughout the reservoir and serve as visual buffers for less desirable views. They also provide a pleasing foreground frame for the distant shoreline or background. Limestone bluffs are distinct scenic elements which occur along a few sections of the main river channel. The sheer rock faces rise from the water with steep, wooded, bluff-like ridges rising several hundred feet more above them. The bluffs provide attractive vertical accents and a natural contrast of colors that can be seen from the distant middle ground.

Other important scenic features include the tranquil, secluded coves and steep, wooded ridges that occur around the reservoir. The isolated coves with wooded shoreline provide peaceful and relatively private locations for overnight boat anchorage although shallow waters limit the use of some. Steep slopes along the shoreline rise mostly undisturbed to wooded skylines. Some ridge tops reach more than 300 feet above the water. The significant elevation changes provide a dramatic contrast to the surrounding reservoir and gently sloping countryside, particularly when they are viewed from background distances.

Watts Bar Dam (TRM 530) is 112 feet high and stretches 2,960 feet across the Tennessee River. The dam skirts the base of a steep, rocky bluff which forms the right abutment of the dam. A flat flood plain stretches for a distance of approximately 750 from the left river bank

to the base of a low bluff which rises about 50 feet in the 300 feet length and then slopes gently toward the top of the east abutment (TVA, 1948).

The shoreline upstream from the dam is naturally appearing and includes several attractive coves. Vegetative patterns are interrupted by transmission line r/w on each bank above the dam. Meigs County Park can be seen intermittently from the cove at Peak-Hornsby Cemetery. Numerous homes along adjacent bluffs and ridges can be seen in the foreground and middleground from the water for approximately five miles beginning at Watts Bar Dam.

The embayment along Piney River at Wolf Creek and Muddy Creek (TRM 533) ranges from approximately 0.5 miles wide in width to over 1.5 miles wide at the confluence of the three streams. This embayment includes public use areas at Rhea Springs Recreation Area and Spring City Park, a Sewage Disposal Plant, and numerous residential and commercial areas. Visual clutter in the embayment is interspersed with unaltered landscapes, particularly along the east side of Wolf Creek. Duck Island, the largest island within the embayment, has a vegetative buffer along the shoreline with an interior that is used mainly for agriculture to benefit wildlife. Scenic attractiveness in the area is common. Scenic integrity is low to moderate.

The main channel of Watts Bar Lake continues east between Goat Island north of Fooshee Peninsula and Iron Hill Island. Fooshee Peninsula features Fooshee Small Wild Area and Fooshee Public Use Area and offers outstanding views of the lake. Goat Island is dominated by pine forest along the shoreline and mature hardwoods on the interior, while Iron Hill Island is characterized by the number of occurring wetlands along the shoreline. Scenic attractiveness is common. Scenic integrity is moderate.

Continuing north, from TRM 540 near Rowden Branch and Hornsby Hollow Recreation Area, several islands can be seen in the foreground from the lake. These islands provide visual contrast and buffers of shoreline development at Rowden Branch as seen from the main river channel. Near TRM 551 is Thiefneck Island, the site of the Fooshee Pass Public Use Area. Visible features along the shoreline include a number of wetland areas. However, the potential for soil erosion is severe in some places. The island is heavily vegetated with some peaks rising over 240 feet above the water surface. Residential development on adjacent shorelines is sparse compared to other areas on Watts Bar Reservoir.

At TRM 558, several islands and a peninsula can be seen in the foreground and middleground distances. These islands are used mainly for wildlife management. Wetland areas are prevalent along the shorelines and the remainder of the islands is heavily vegetated, providing visual contrast to shoreline development along this section of the reservoir. Near TRM 562, Caney Creek enters Watts Bar Reservoir. From the confluence of Caney Creek and Watts Bar Reservoir, New Hope Road Bridge can be seen in the foreground. Farther upstream, human alterations include water-use facilities and Roane County Park.

The next six miles of upstream (TRM 562 to 568) to the confluence of Tennessee and Clinch Rivers, views of the shoreline include subdivisions and homes with their associated docks and water-use facilities. Views include occasional passing highway traffic in the foreground and middleground. Several ridgelines rise approximately 300 feet in the background with development visible on some slopes. The visual congestion along this

area is generally viewed in the foreground, therefore scenic attractiveness is minimal and scenic integrity is low. When viewed from greater distance across the reservoir, details become weaker and scenic value improves.

The main channel bends to the southeast and a wide range of landforms in the middleground and background provide visual relief from human alteration along the shoreline and back-lying land. These landforms include ridges ranging from 100 to 200 feet in height, and valleys accentuated by natural vegetative patterns. Islands along the channel, particularly those larger than five acres, provide visual buffers of shoreline development. Riley Creek Recreation area is located on the right bank near TRM 570, approximately one mile west of Long Island.

Upstream of Long Island near Smith Creek embayment, the main reservoir narrows to a riverine character. Shoreline development is sparse and heavy vegetation covers the naturally appearing slopes. The channel becomes again broadly horizontal near Huffine Island and Paint Rock Wildlife Management Area. Wide shoreline areas are accentuated by sparse vegetation, and gently sloping topography is used mainly for farm land. Embayments enter the main channel on each side of the lake and are mainly unaltered by human activity. Scenic attractiveness is common. Scenic integrity is moderate.

At TRM 577, moderate development can be seen on the left bank from the water. Views of development along the right bank are less discernible due to broad bands of vegetation along the shoreline. At TRM 583, residential development becomes increasingly heavy and is a focal point in the landscape. Visual clutter along the shoreline is relieved intermittently for recreation users in the water by Matlock Island (TRM 583.5) and Sweetwater Island (TRM 584.5).

3.12.2. Environmental Setting of the Clinch River Segment of Watts Bar Reservoir

The tailwaters of the Clinch River Segment of Watts Bar Reservoir enters Watts Bar Reservoir at approximately TRM 568 (CRM 0) just downstream of the City of Kingston. This section of the Clinch River is characterized by dense residential development along the shoreline. At approximately CRM 2.5, the I-40 and Roane State Highway bridges crossing the Clinch River are viewed in the foreground distance and Kingston Fossil Plant (KFP) in the middleground. Views of KFP are mainly of the smokestacks and broadly horizontal industrial facilities. Scenic attractiveness is minimal. Depending upon viewer location, scenic integrity is low to very low.

At CRM 5, the industrial setting of KFP transitions to sparse residential development on the right and left banks. This riverine setting is less altered with the exception of occasional private water use facilities seen along the shoreline. From CRM 5 to 11, landscape character ranges from light residential and open space to natural woodlands. Several scenic coves are seen along this section of the Clinch River with high ridges in the background, retaining moderate scenic integrity.

At approximately CRM 11, industrial facilities at the USDOE K-25 Plant (currently being decommissioned) come into view on the left bank. Numerous transmission lines, industrial facilities, and broadly horizontal buildings combine to create a concentration of mixed shoreline development. The results are extensive visual congestion, adverse contrast, and very low scenic integrity. Upstream, at CRM 14, the former Clinch River Breeder Reactor site is on the left bank. From the reservoir, this site appears mainly undisturbed due to extensively retained shoreline buffers. However, the site has been greatly altered through

vegetative removal and earthwork operations. Beyond the former Clinch River Breeder Reactor site, at CRM 19 to 21, the landscape on the right bank becomes predominately agriculture while the left bank appears unaltered and is heavily wooded. Jones Island, one of the largest islands along this portion of the reservoir, is naturally-appearing and has excellent scenic value.

3.12.3. Environmental Setting of the Emory River Segment of Watts Bar Reservoir

The Emory River segment of Watts Bar Reservoir begins just beyond CRM 4 east of KFP. The KFP environmental setting was previously discussed in section 3.1.2. At ERM 2, northeast of KFP, the shoreline character becomes mainly light residential interspersed with tracts of undisturbed woodlands and agriculture lands. At ERM 5 the main body of water turns west towards Harriman and the Little Emory River tributary enters from the north at this point.

The Little Emory River tributary at the mouth of the Emory River is a riverine setting punctuated by sparse residential development on each bank. To the east, Pine Ridge rises over 300 feet and provides visual contrast to the lower-lying shoreline areas. Residential development becomes more concentrated near Harvey Hannah Highway to the north. Water use facilities and boat ramps become more prevalent in the landscape in this area and there is a reduction in visual integrity. This portion of the Watts Bar Reservoir terminates near Bitter Creek Highway.

The Emory Creek section of the Watts Bar Reservoir continues from ERM 5 and traverses west through rural countryside. From the water, this section of river is naturally-appearing due to the wide vegetative buffers along the shoreline. Brief views of residential areas and altered landscapes can be seen periodically, particularly within small coves along the river. At ERM 7, the natural landscape transitions from open space to heavy residential at TRM 10 east of Harriman. Automobiles are frequently seen along local roads, as well as myriad transmission and utility lines. Taller buildings to the north become focal points in the landscape. This portion of the Watts Bar Reservoir terminates near William Hampton Browder Bridge on US 27.

3.13. Socioeconomic Impacts

Both social and economic values and activities pertaining to the Watts Bar Reservoir area are derived primarily from the local communities and their livelihoods. Meigs, Loudon, Rhea, and Roane Counties are decidedly rural in description with several locally important towns or small cities.

Population: The four counties in the Watts Bar Reservoir area had a population of 130,482 in 2000, an increase of 17.7 percent since 1990 (see Tables 3.13-1 and 3.13-2). This was a faster growth rate than in either the state or the nation, in contrast to the previous decade in which the area grew much more slowly than the state and the nation. Projections indicate that this faster growth is likely to continue for the next several years. Meigs County, the smallest of the four counties in the area, had the fastest growth rate between 1990 and 2000. Roane County, the largest of the four, had the slowest growth rate after a loss of population between 1980 and 1990. All four counties grew much faster from 1990 to 2000 than in the previous decade.

Table 3.13-1 Population and Population Projections, 1980-2020

	1980	1990	2000	2010	2020
Loudon County	28,553	31,255	39,086	48,362	58,729
Meigs County	7,431	8,033	11,086	14,768	19,040
Rhea County	24,235	24,344	28,400	32,809	37,665
Roane County	48,425	47,227	51,910	57,042	61,836
Area Total	108,644	110,859	130,482	152,981	177,270
Tennessee	4,591,023	4,877,185	5,689,283	6,425,969	7,195,375
United States (000)	226,542.2	248,709.9	281,421.9	308,936	355,805

Source: Historical data from U. S. Census Bureau, Census of Population 1980, 1990, and 2000; state and county projections from Tennessee Advisory Commission on Intergovernmental Relations and the University of Tennessee Center for Business and Economic Research, *Population Projections for the State of Tennessee, 2005 to 2025,* December 2003; U. S. projections from U. S. Census Bureau, "U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin," March 2004.

Table 3.13-2 Percent Change in Population

	1980-1990	1990-2000	2000-2010	2010-2020	1980-2020
Loudon County	9.5	25.1	23.7	21.4	105.7
Meigs County	8.1	38.0	33.2	28.9	156.2
Rhea County	0.4	16.7	15.5	14.8	55.4
Roane County	- 2.5	9.9	9.9	8.4	27.7
Area Total	2.0	17.7	17.2	15.9	63.2
Tennessee	6.2	16.7	12.9	12.0	56.7
United States	9.8	13.2	9.8	8.7	48.2

Labor Force and Unemployment: In 2003, the civilian labor force of the area was 63,030, as shown in Table 3.13-3. Of these, 3,400 were unemployed on average during the year, yielding an unemployment rate of 5.4 percent. This rate was lower than both the state and the national rates.

Table 3.13-3 Labor Force Data, Residents of Watts Bar Reservoir Area, 2003

	Civilian Labor Force	Unemployment	Unemployment Rate (%)
Loudon County	21,850	920	4.2
Meigs County	4,750	390	8.2
Rhea County	12,130	760	6.3
Roane County	24,300	1,330	5.5
Area Total	63,030	3,400	5.4
Tennessee	2,909,500	169,000	5.8
United States	146,510,000	8,774,000	6.0

Source: Tennessee Department of Labor and Workforce Development.

Jobs: In 2002, total employment in the 4-county area was 58,215, an increase of 6.9 percent since 1992 (Tables 3.13-4 and 3.13-5). This was a much slower rate than in the state and the nation. However, Meigs County grew much faster and Loudon County somewhat faster than both the state and the nation. Roane County had a decrease in employment of almost 10 percent.

The area is more dependent on manufacturing, farming, and government employment than either the state or the nation (Table 3.13-6). Farm employment accounted for 5.4 percent of the total in 2002, notably higher than the state average of 3.1 percent and the national average of 1.8 percent. Both Loudon and Meigs Counties have relatively high farm employment, while Rhea and Roane Counties have farm employment shares more like the state. Manufacturing employment is especially dominant in Rhea County, at 34.4 percent of the total, compared to 12.7 percent in the state and 9.5 percent nationally. It is also relatively high in Loudon County, 17.9 percent of the total, and slightly higher than the state in Meigs County, at 14.2 percent. Government employment is higher than both the state and national averages in Rhea and Roane Counties.

Nationally, as production has become more efficient and as the economy moves more and more to a service economy, manufacturing employment has declined by 15.5 percent from 1992 to 2002. The state of Tennessee has followed that trend with a decline of 16.3 percent between 1992 and 2002. The counties in the Watts Bar Reservoir Area also followed that trend, with the exception of Meigs County which had a 10.8 percent increase in manufacturing employment. Roane County had a 48.1 percent decline, while Loudon and Rhea Counties experienced much smaller declines, 2.9 percent and 1.6 percent, respectively.

Table 3.13-4 Employment, 2002

	Total	Farm	Manufacturing	Government	Other
Loudon County	16,282	1,459	2,919	2,079	9,825
Meigs County	5,506	437	781	464	3,824
Rhea County	14,156	549	4,866	2,392	6,349
Roane County	22,271	694	2,104	4,387	15,086
Area Total	58,215	3,139	10,670	9,322	35,084
Tennessee	3,463,526	105,851	440,181	429,523	2,487,971
United States (000)	167,033.5	3,075.0	15,800.4	23,346.0	124,812.1

Note: Includes full and part-time employment, proprietors and wage and salary employees.
Source: U. S. Bureau of Economic Analysis, Regional Economic Information System.

Table 3.13-5 Percent Increase in Employment, 1992-2002

	Total	Farm	Manufacturing	Government	Other
Loudon County	22.9	-0.1	-2.9	34.0	35.9
Meigs County	55.7	2.8	10.8	24.7	88.0
Rhea County	8.6	16.1	-1.6	-14.9	32.2
Roane County	-9.5	2.5	-48.1	16.8	-6.5
Area Total	6.9	3.4	-16.1	9.8	16.2
Tennessee	21.3	0.2	-16.3	10.4	35.7
United States	20.0	0.6	-15.5	8.7	30.1

Note: Due to changes in industrial classification, data by industrial category for 2002 and for 1992 are not totally comparable.

Table 3.13-6 Percent Distribution of Employment, 2002

	Total	Farm	Manufacturing	Government	Other
Loudon County	100.0	9.0	17.9	12.8	60.3
Meigs County	100.0	7.9	14.2	8.4	69.5
Rhea County	100.0	3.9	34.4	16.9	44.9
Roane County	100.0	3.1	9.4	19.7	67.7
Area Total	100.0	5.4	18.3	16.0	60.3
Tennessee	100.0	3.1	12.7	12.4	71.8
United States	100.0	1.8	9.5	14.0	74.7

Occupation Patterns: The area has fewer of its workers in the management, professional, and related occupations, as well as in sales and office occupations than does either the state or the nation (Table 3.13-7). This pattern holds for all of the four counties in the area. Conversely, all four counties have relatively more workers in the construction, extraction, and maintenance occupations and in production, transportation, and material moving occupations than the state or the nation. The share of workers in service occupations is similar to the state, but smaller than the national average. Farming, fishing, and forestry occupations account for only a small share in any of the counties, but the share is higher than the state and national averages except in Roane County.

Table 3.13-7 Occupation of Workers (Percent Distribution), 2000

Occupation Class:	Loudon	Meigs	Rhea	Roane	Area Total	State	U. S.
Management, Professional, and Related	25.6	16.6	18.5	26.7	23.8	29.5	33.6
Service	13.3	12.9	13.3	14.4	13.7	13.7	14.9
Sales and Office	25.3	19.4	20.4	22.4	22.7	26.1	26.7
Farming, Fishing, and Forestry	0.9	1.7	1.1	0.5	0.8	0.6	0.7
Construction, extraction, and maintenance	12.2	15.2	11.9	13.3	12.8	10.3	9.4
Production, transportation, and material moving	22.7	34.2	34.8	22.7	26.2	19.9	14.6

Source: U. S. Census Bureau, Census of Population 2000.

Income: Per capita personal income in all four of the area counties is lower than the state and national averages, ranging from 63.8 percent of the national average in Meigs County to 84.8 percent in Loudon County. Loudon County gained slightly compared to the nation between 1992 and 2002, from 84.5 percent to 84.8 percent of the national average. The other area counties, however, declined relative to the national average. The area as a whole averaged 76.0 percent of the national average in 2002, down from 78.5 percent in 1992.

Table 3.13-8 Per Capita Personal Income

	1992	Percent of U. S., 1992	2002	Percent of U.S., 2002	Percent Change, 1992-2002
Loudon County	17,613	84.5	26,212	84.8	48.8
Meigs County	13,659	65.5	19,711	63.8	44.3
Rhea County	14,605	70.0	20,492	66.3	40.3
Roane County	16,935	81.2	23,878	77.3	41.0
Area Total	16,375	78.5	23,503	76.0	43.5
Tennessee	18,577	89.1	27,611	89.3	48.6
United States (000)	20,854	100.0	30,906	100.0	48.2

Source: U. S. Bureau of Economic Analysis, Regional Economic Information System.

3.13.1. Environmental Justice

The minority population in the Watts Bar Reservoir area is small, 4.9 percent of the total in 2000, which is well below the state average of 20.8 percent and the national average of 30.9 percent (Table 3.13-9). Within the four counties in the area, the minority population ranges from 2.7 percent of the total in Meigs County to 5.4 percent in Rhea County. The estimated poverty rate in the area in 2002 was 13.2 percent, slightly lower than the state rate of 13.6 percent, but higher than the national average of 12.1 percent. Among the counties in the area, poverty rates range from 10.4 percent in Loudon County to 17.9 percent in Meigs County.

Table 3.13-9 Minority Population, 2000, and Poverty, 2002

	Population	Minority Population			Poverty
	Total	Nonwhite	White Hispanic	Percent Minority	Percent Below Poverty Level
Loudon County	39,086	1,604	272	4.8	10.4
Meigs County	11,086	260	38	2.7	17.9
Rhea County	28,400	1,303	217	5.4	15.2
Roane County	51,910	2,470	241	5.2	13.2
Area Total	130,482	5,637	768	4.9	13.2
Tennessee	5,689,283	1,125,973	57,380	20.8	13.6
United States	281,421,906	69,961,280	16,907,852	30.9	12.1

Source: U. S. Census Bureau, Census of Population 2000; U. S. Census Bureau, Small Area Income and Poverty Estimates, December 2004.

3.14. Air Quality

National Ambient Air Quality Standards establish safe concentration limits in the outside air for six pollutants; particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. These standards are designed to protect public health and welfare. An area where any air quality standard is violated is designated as a nonattainment area for that pollutant, and emissions of that pollutant from new or expanding sources are carefully controlled. Except for ozone and particulate matter, all counties that surround Watts Bar Reservoir and their surrounding counties are currently in attainment. In July 1997, USEPA promulgated new, more restrictive standards for ozone and fine particulate matter (PM-2.5). These new standards include an 8-hour standard for ozone and 24-hour and annual standards for PM-2.5. USEPA has begun implementation of these new standards, and issued final designations for 8-hour ozone in April 2004 and for PM-2.5 in January 2005.

Nonattainment counties for 8-hour ozone concentrations include Loudon and Meigs among the Watts Bar Reservoir lands counties. Other nonattainment counties that are adjacent to the Watts Bar Reservoir lands counties are Knox and Blount adjacent to Loudon, Anderson adjacent to Roane, and Hamilton adjacent to Meigs. The PM-2.5 nonattainment designations include Loudon County and part of Roane County and the nearby counties of Anderson, Blount, Knox, and Hamilton.

Prevention of Significant Deterioration (PSD) regulations are used to limit air pollutant emissions from new or expanding sources. Under these regulations, some national parks and wilderness areas are designated PSD Class I air quality areas and are specially protected. The closest PSD Class I area is the Great Smoky Mountains National Park to the east and southeast from Watts Bar Reservoir. The shortest distance to the nearest border of the park is from the upper end of the reservoir close to Ft. Loudoun Dam and is about 20 miles (32 kilometers).